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Machines and Men

Intensive Training for Young Engineers

WE were not prepared on the outbreak of war to provide the vast number of technically trained men which events have shown to be essential to victory and now that the facts are fully realised our problem is to find such men for the factories, the Supply Departments and the Forces and, moreover, to carefully weigh the needs of each in order to secure the proper balance.

The kind of man principally required for the Forces is one with adequate training and experience, and the initiative and resourcefulness which these bring when properly assimilated. In the earlier stages of the war it was found that a sufficient supply of this type could be obtained directly by the Services from within and partly from the universities and technical colleges and from volunteers above the "reserved" ages.

But the rapidly increased tempo has practically exhausted the possibilities in this direction, with the consequence that the Services must turn to the only other available source—industry itself. Therefore the Technical Personnel Committee, which is charged with the task of dealing with questions relating to the supply of technical men of professional or "approximately professional" standards, has recommended a detailed review of the cases of young engineers who have been "reserved" for service in industry.

In suitable cases these men will be put forward for commissions in the various technical Arms of the Navy, Army and Air Force, but at the same time their employers will be given an opportunity of stating a case for their retention. It is hoped that no employer will raise objections unless the man concerned is vitally important to production.

The authorities fully realise, however, that they cannot take young technical men from the works without doing something to replace them, although it is obvious that they cannot be replaced by men equally as valuable. What it is proposed to do is to conserve a great deal of the promising "raw material" which now exists in industry and subject it to a speeded-up training calculated to produce men of approximately Higher National Certificate standard in six months.

Although the term "raw material" has been used, quite clearly it cannot be too raw if satisfactory results are to be obtained in so short a period. The kind of young man who will be selected for the intensive training courses is primarily of the grade which has got as far as the Ordinary National Certificate but has been prevented from going further for various reasons.

While undergoing a course the selected men will be given a generous subsistence allowance so that they will generally not be much, if any, worse off than if they remained in the factory and will receive permanent benefit from their free tuition.

It will be seen that from the men's point of view the scheme is most attractive, but

their employers may not feel so happy at losing them—even for six months. Therefore employers are urged to realise the great need and encourage as many of their suitable employees as possible to take one of the courses. Most of these men will return to industry on completion of their course better qualified to meet the requirements imposed upon them. Employers are also appealed to for help in providing the teachers which it will be necessary to find to supplement the staffs of the technical colleges.

We know that the electrical industry can be relied on for its support to the lead given by the Institution of Electrical Engineers in co-operation with the " Mechanicals."

Maximum Demand

SUCH a basis of assessing the fixed component of a domestic tariff as floor area may bear little relation to individual maximum demands, but it furnishes a revenue which should roughly cover the standing charges of the supply undertaking for the whole group. Departures from the average tend to cancel one another out. Industrial requirements are more diverse and are often large enough to make economically necessary a tariff that in each instance reflects production costs as closely as practicable. This we believe to be, in brief, the answer to certain criticisms made last Friday during the discussion by the I.E.E. Meter and Instrument Section of defects in present methods of measuring maximum demands which Mr. D. J. Bolton diagnosed in his paper. Some implications of the latter are dealt with by the author in this issue.

Cutting the Peak

LAST week we referred to the endeavours made at Guildford to reduce the system peak, thereby decreasing both consumption and grid charges. At Gloucester recently the local branch of the Electrical Contractors' Association invited the city electrical engineer (Mr. F. H. Corson) and local retailers of electrical goods to meet them and discuss means of reducing the city's peak between 8 and 9.30 a.m. Reporting the matter in the December *Electrical Contractor*, " Pilgrim Two " says that it was thought that the cutting out of " unofficial " heaters in works already properly warmed would do much to relieve the position and several of the largest shops agreed to do without window lighting in the morning. It was agreed to make a tactful approach to the public and all the shops concerned are now exhibiting notices explaining the situation to the public. A great deal can be done in the Fuel Economy Campaign by such co-operation between electrical people.

Quick Work

To bring into operation a large generating station within eighteen months of its official authorisation is a notable feat. The Watts Bar station of the Tennessee Valley Authority, 120,000 kW of which is expected to be running next February in connection with the defence programme, has been designed primarily with a view to speedy construction and so only proved equipment is said to have been employed. Yet the station with its three 60,000-kW turbo-alternators, each supplied with steam at 850 lb. per sq. in. and 900 deg. F. from a single 600,000-lb. per hr. boiler, is expected to show a net thermal efficiency of close on 29 per cent. It effectively demonstrates the value of progressive thermo-dynamic ideas in normal times that so relatively advanced a design can be regarded as suitable for adoption for a " rush job."

Other People's Bread

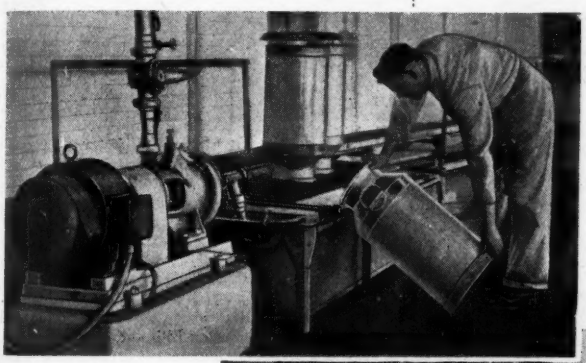
WHILE it is not possible nowadays for anybody who cares to to enter the food supply business, the restriction is at present one-sided. An E.C.A. branch complains that a local food trader has taken up the sale of domestic electrical appliances. Thus a man whose business it is to put bread into people's mouths is taking it out of somebody else's. Another branch mentions a printer who has " barged into " the electrical business. The Board of Trade's Retail Trade Committee recognised the undesirability of this sort of thing, on a number of grounds, and made recommendations designed to put a stop to it. Among the classes of business to which, it was recommended, entry should be restricted by a licensing system were electrical goods and appliances; radio goods, gramophones and accessories; and electric torches and batteries therefor. It is to be hoped that the Order framed upon the Committee's recommendations will prevent what is left of the electrical retailing business being split up among half the shops in the country.

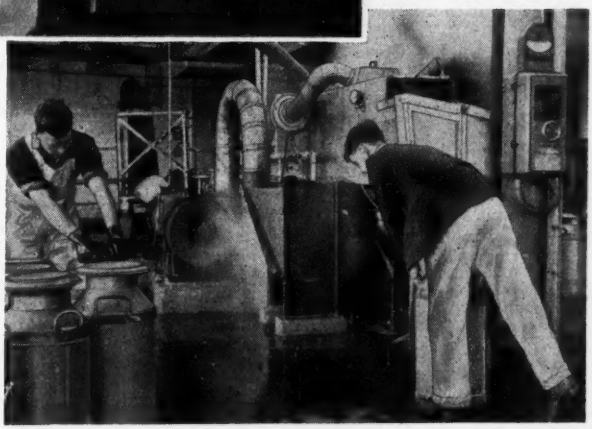
Condensed Milk

Meeting an Urgent Present-day Need

NOW that our fresh milk supplies are being restricted and supplemented by condensed milk, we have reason to look on the latter in a new light, for we have probably hitherto regarded it mainly as a useful stand-by. As will be realised from the following description of the manufacturing process, which in the main consists of evaporating the water content, condensed milk differs little in food value from fresh milk and indeed is to be preferred for some purposes. This, of course, is quite apart from the other advantages such as the preservation of milk at periods of the year when it is plentiful, storage for an almost indefinite time in a small space, and easy transport.

This completely "motorised" factory has its own 760-kW generating plant producing direct current at 220 V



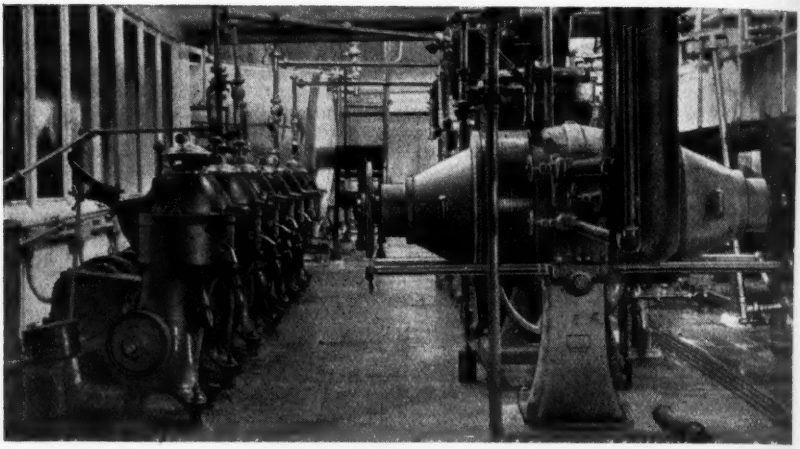


After being poured into the receiving tanks the fresh milk is taken by means of the pump in the foreground to the cooler and (right) clean churns leaving the continuous washer and dryer

As with nearly every industry, electricity here plays a very prominent part. This was made very clear to us by a recent visit to a factory of the Wilts United Dairies, Ltd., in Somerset, which, converting 60,000-70,000 gallons of fresh milk a day, employs electricity in one way or another in practically every process. Churns full of milk arriving by lorries are emptied straight into reception tanks and placed on a conveyor which, driven through reduction gearing by a 2-HP, 950-RPM motor, carries them through a U.D. Engineering Co. automatic washer and dryer (10-HP, 1,400-RPM motor) ready for returning immediately to the lorries. The whole of the unloading, emptying, washing, drying and reloading thus takes only a few moments, and economises in the number of churns required.

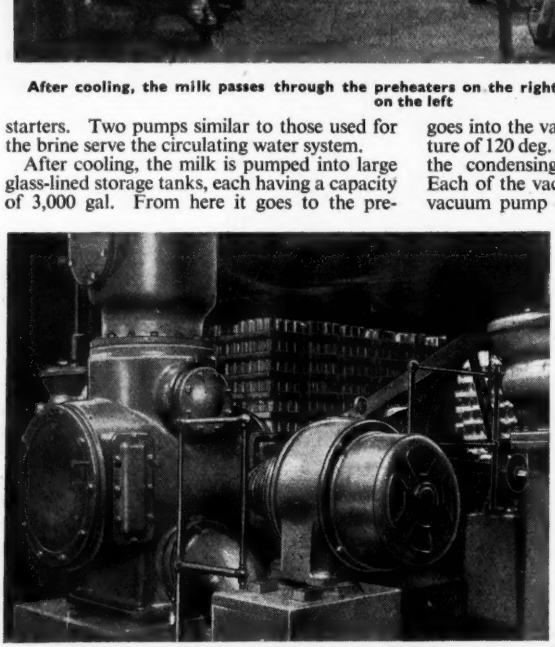
From the receiving tanks the milk is taken by two Pullen pumps (3½-HP, 1,400-RPM motor) through an Aluminium Plant & Vessel Co. heat exchanger to cool it. The brine is circulated through the cooling system by means of two Pearn pumps (25-HP, 1,400-RPM motors) arranged in duplicate, and the temperature is lowered by means of U.D. Engineering Co. ammonia compressor plant comprising two units each of 850,000 BThU capacity, driven by

100-HP, 1,000-RPM Mersey motors and one unit of 850,000 BThU capacity direct driven by an oil engine. The machines are controlled by E.A.C. starters. Two pumps similar to those used for the brine serve the circulating water system.



After cooling, the milk passes through the preheaters on the right to the separators or cleaners on the left

After cooling, the milk is pumped into large glass-lined storage tanks, each having a capacity of 3,000 gal. From here it goes to the pre-heaters (2½-HP, 960-RPM motors) where the chill is taken off before it is treated in the separators or cleaners, each operated by a 6-HP, 1,450-RPM motor. Pasteurisation is the next process, this being done by machines driven by 2½-HP, 960-RPM motors. Passing on to stainless steel boiling pans the milk, with sugar added if it is to be sweetened, is boiled, and then goes into the vacuum pans where at a temperature of 120 deg. F. and under a vacuum of 26 in., the condensing process proper takes place. Each of the vacuum pans has its own separate vacuum pump (Frederick Pearn & Co.) which is driven at 720 RPM by a 20-HP motor.



One of the pumps serving the vacuum pans where the condensing process proper takes place

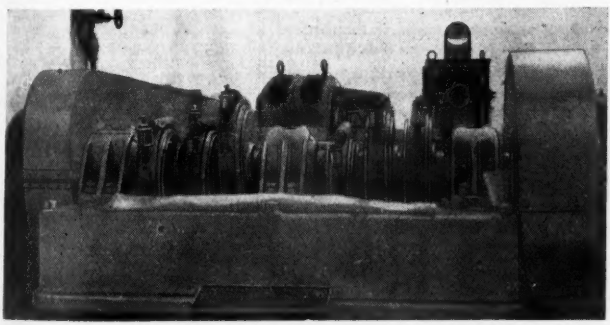
At this stage sweetened and unsweetened milk follow different procedures. The sweetened milk when it leaves the vacuum pans goes to the holding tanks, whence it is pumped through coolers by means of Morton gear pumps equipped with 5-HP, 1,000-RPM geared motors. Leaving the coolers the milk is stored in glass-lined tanks to await canning. All the cans used for the sweetened milk are made in the factory.

For the filling of the cans, machines made by the U.D. Engineering Co., Ltd., are used; they are driven by 2-HP, 1,200 RPM motors. The operation is entirely automatic; the milk and the cans are both fed in at the top of the machines, and the filled cans pass along conveyors to Bliss seamers for sealing on the tops. Labelling is then carried out at the rate of 120 cans a minute on Wright & Marvin and Beth machines, driven by ¾-HP, 1,000-RPM motors and fitted with

electrically heated gluepots, and the cans pass along Pantin conveyors (2- and 3-HP, 940-RPM motors) for storage, packing and dispatch. Incidentally, all the wooden boxes used for packing are made on the premises by means of motor-driven nailing machines (A. B. Miller & Co.) and the ends of the boxes are printed by means of a Collis machine driven by a 4-HP, 1,000-RPM motor. For lifting boxes, stacks of tins, etc., in the store rooms three Morris 20-cwt. hoists are employed.

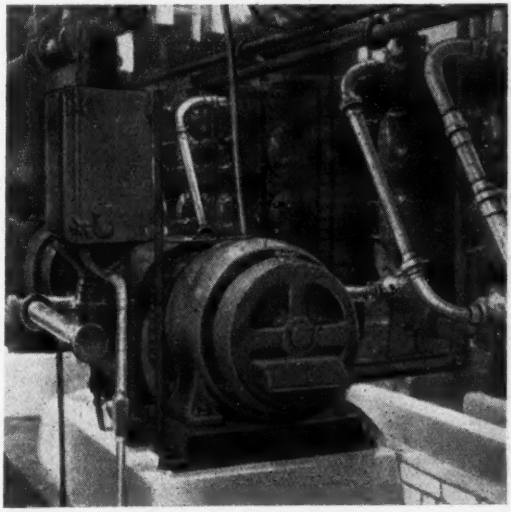
Not containing sugar to act as a preservative, the unsweetened milk has to be sterilised. Before this, however, it goes from the vacuum pans to holding tanks and then to homogenisers driven by 35-HP, 620-RPM motors. Like nearly all the motors in the works these are equipped with E.A.C. starters. After homogenisation the milk is passed through an A.P.V. brine cooler, which, as in the case of the cooling apparatus for the sweetened milk, is served by the refrigeration system utilised for the initial cooling of the raw milk.

Arriving at the glass-lined storage tanks from the coolers, the unsweetened milk is kept stirred by means of agitators driven by 2-HP, 1,000-RPM motors. For filling the cans machines of the same type as those handling the sweetened milk are used in conjunction with Canco seamers (3-HP, 1,400-RPM motors). The cans are then ready for sterilising. This process takes about 40 minutes and the milk is subjected to a temperature of about 114 deg. C., a Short & Mason visual recorder keeping a check on the operation. After sterilising, the cans are labelled, taken to storage and packed and dispatched in the same way as sweetened milk.



Homogeniser for the unsweetened milk

As a large quantity of steam is required for the sterilising, churn washing, etc., the company finds it more economical to generate its own electricity rather than purchase it from the public supply. The steam is raised by five Babcock & Wilcox boilers, 54,000 lb. per hour total capacity, the coal for which is sucked direct from railway trucks or bunkers by means of a Simon pneumatic conveyor operated by a 27-HP, 960-RPM motor. For the steam process work the steam is kept under pressure by means of a Ruths steam accumulator.



Pumps for passing the sweetened milk through the coolers

The generating plant, which produces DC at 220 V, consists of two Belliss & Morcom engines driving 250-kW Lancashire Dynamo generators at 430 RPM, and one Allen equipment consisting of an engine driving a 150-kW generator at 400 RPM. In addition there is a National four-cylinder oil engine driving a 100-kW E.C.C. generator at 500 RPM, and also a small National lighting set driving a 15-kW Lancashire Dynamo generator at 1,000 RPM. All the generators are compound wound. Controlling the supply to the factory is a switchboard

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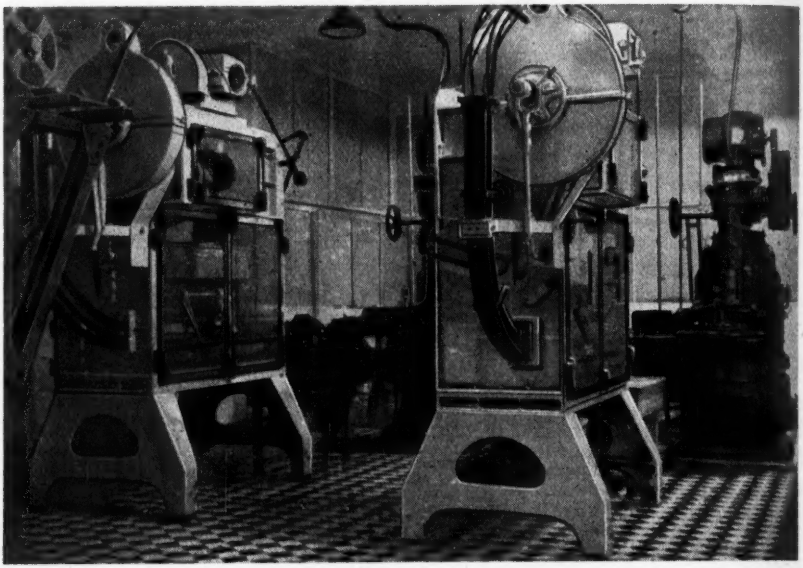
built up with Ellison and Mudie equipment.

Most of the electric motors used in the factory were supplied by Lancashire Dynamo & Crypto, Ltd., and the City Electrical Co.

Our thanks are due to the Wilts United Dairies, Ltd., for permission to inspect the factory, and also Mr. F. G. Maslen, the manager, and Mr. R. C. Goodall, the factory's chief engineer, for the assistance they gave in the preparation of this article.



Filling and seaming machines for the unsweetened milk

Rural Electrification in Canada

WAR conditions have very considerably increased the use of electricity for agriculture and horticulture in the Fraser Valley area of British Columbia. Possibly in no similar area of its size in Canada is there the same wealth of variety in agricultural undertakings. Milk, eggs, potatoes, hops, tobacco, flax, fruits, vegetables, honey, hay, dried grass and furs are only a few of the long list of products of the Valley, and electrification has touched every one of these industries. To-day over 7,000 farmers in the Valley are served with electrical energy for some form of farm operations apart from domestic light and power. This development is considered outstanding in Canada, and is largely due to promotional work of the B.C. Electric Railway Co. for many years.

Last spring, as the labour shortage became acute in Fraser Valley, sales of electric milking machines to dairy farms increased rapidly, and an average of one installation per day was recorded for the months of May and June. In the previous spring 150 electric milkers were installed in the Valley. Water is electrically heated in over 100 dairies in the bottled milk area of the lower Fraser Valley. Electrical refrigeration is universal in the milking and bottling districts, and electricity is used in dairy farms for every variety of purpose from clipping cattle to filling silo and preparing fodder.

First place in intensification of the use of electricity on Valley farms is held by the poultrymen. Two of the larger hatcheries each produced over a million chicks last spring in electric incubators. Over 2,000 electric brooders are in operation in the Valley.

Following the lead of their neighbours in Washington and Oregon, an increasing number of Fraser Valley farmers are applying sprinkler irrigation to crop production. Blessed as British Columbia is with an abundant annual rainfall, there is still hardly a year when growth does not stop in late summer due to lack of moisture. Artificial rain, applied systematically, combined with a programme of fertilisation and soil management, has made it possible to double the dairying capacity of Valley land. Verdant pastures late in the fall, relieving the drain on hay and ensilage stocks, have justified the investment in equipment. For example, on one farm a pumping plant has doubled the feed capacity. Dairymen with pasture, and small fruit ranchers and truck farmers, are the type mainly benefiting by sprinkler irrigation installations.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

"Engineering—Unlimited"

HAVING had many years' administrative experience in the maintenance of electrical plant by contract, I have been particularly interested in the recent correspondence in your journal on the above subject. The present labour shortage emphasises the advantages to be gained from contractors' services for maintaining plant, and I endorse the opinion of Mr. H. Marryat, who is, of course, an authority on the subject.

With the exception of the larger works, managements do not find it economical to employ "own staff" to service their plant, and it is the medium and smaller works, now working to capacity, where the merits of contractors' maintenance service is most evident. Where the size of the works justifies the employment of "resident" electrical staff, minor defects may be rectified a little sooner than awaiting the contractor, but a major breakdown of a "key" driving unit can illustrate the limitations of "own staff." A first-class firm of maintenance contractors can deal expeditiously with breakdowns, not only on account of the wide and varied technical experience of their trained staff, but in addition, the organisation possesses facilities which are not usually available to resident staff.

The following may illustrate a few of the contractors' resources for servicing plant:—

(*a*) Ample skilled men, trained in the diagnosis of electrical faults, available by telephone in any area.

(*b*) A rewinding department where urgent burn-outs or coil failures can be promptly dealt with, resulting in the great saving of the time which would otherwise elapse in the case of special plant being returned and redelivered, to and from makers' works. It should be noted here that the average manufacturer, whose works are laid out for the production of new machines in large numbers, is less favourably situated to deal promptly with repairs to isolated machines of his own manufacture.

(*c*) The holding of a large number and variety of spare motors, generators and control gear, which can be temporarily installed in an emergency, while repairs to defective plant are carried out.

(*d*) The stocking of adequate spares, in selected areas, in the form of control gear contacts, carbon brushes, ball and roller races, etc., for most types of machine in use.

There is little foundation for the works manager's "nightmare" of a large-scale shutdown owing to the absence of "own staff." Modern practice, with individual or small group drives, dispels this apprehension, but as regards a works driven by a large unit, the efficient contractor would make early recommendations to eliminate such a weakness by splitting the drives wherever possible. In this connection, it is an essential part of the contractors' maintenance service, with the accumulated experience of all classes of plant, to render such advice to individual plant users as will result in the more efficient operation of the works and prevent the breakdown before it occurs.

Twickenham. W. MACMAHON,
Member, E.C.A.; Member, A.S.E.E.
(Late of Burdette & Co., Ltd.).

Preserving Wood Poles

WITH regard to Mr. Reynolds' letter in your issue of November 28th concerning the preservation of wood poles, I should very much doubt whether greatly beneficial results would be obtained from the methods suggested. As he says, the penetration obtained by brushing the poles over with creosote, or soaking them for a time, is very small. The suggested bandaging of poles would stop all ventilation of the timber, and by doing so, would produce decay.

I do not think that a concrete collar would be of much benefit, as if it is intended as a support to the pole it will be useless unless carried to a considerable height, and also to a considerable depth below ground. Also, in my experience, it is impossible to obtain a tight joint between concrete and timber, and moisture will penetrate and produce further decay. I remember a case a number of years ago where a quantity of poles were put into concrete sockets which stopped ventilation; the wet got in at the top and I think the poles decayed in a very short time.

The only proper and satisfactory method of preserving poles is pressure impregnation with creosote in a proper cylinder. There are a great number of such creosoting works all over the country, and there is not the slightest doubt that users of poles would be very well advised to purchase from a reputable firm who can thoroughly impregnate them and thereby ensure as far as possible a reasonable life. Unless the poles are only intended to remain upright for a few months, or a year or two, it seems false economy to erect them if they are only treated by brush or similar methods.

I think I am right in saying that there are some poles now standing in this country which have been up for 70 years and are still in good condition, and a very great number which have been up for lesser periods (40 or 50 years); these were all pressure creosoted, and the

general use of this process by the Post Office and leading users shows it to be the best and only reliable method.

People who erect poles or timber of any kind, such as fencing, treated by rudimentary methods, are asking for trouble and are being penny wise and pound foolish.

CHRISTOPHER WADE.

Bedford. (Gabriel, Wade & English, Ltd.)

REFERRING to the letter in your issue of November 28th, in 1920-21 I was responsible for the purchase and erection of English larch poles and all the incidental treatment, and many of these poles are still standing.

I think Mr. Reynolds is a little pessimistic. I should like to refer him to Bulletin No. 8, issued by the Forest Products Research dealing with the use of home-grown larch poles for transmission lines. When using home-grown larch it is of importance to get a pole with a high proportion of heartwood. The pole must not only be barked but also thoroughly skinned. I have seen poles that have had the skin left on them in which the whole of the sapwood has turned to powder, but if this outer skin is removed and the pole incised, no rotting or very little rotting will occur.

For protection of the pole at ground line I have found that the best thing is to char the pole thoroughly, rolling it over a wood fire made of the bark, and then tar it after erection. In my opinion pressure creosoting of larch poles is of little use, because they only take about a tenth of the amount taken by the imported red fir. It is usually as well to paint over the pole with creosote to prevent trouble from insect pests at the beginning of its life.

I cannot stress too strongly the necessity for fully skinning and incising the pole before erection. The charring may be considered unnecessary, but it is an old-fashioned method which has been used in the country on many estates for posts, such as larch posts, set in the ground, and is certainly effective.

Gloucester. W. HILL.

Factory Lighting Installation

ONE of the lessons which the war has taught us is that lighting installations good enough for comparatively few hours of use in peacetime are not satisfactory for continuous use in wartime. An excellent example of the manner in which lighting in industrial plants can be substantially improved is an installation recently carried out at an industrial establishment converted to the production of munitions. Here the work undertaken is that of turning and machining of ferrous bars and ingots, and also the machining and pressure fitting of copper and brass parts. Before the new installation was provided the majority of the machines were fitted with local lights, but these are no longer required.

Crompton "Glassteel" diffuser units in a shell factory

In one of the shops the lighting is general, an average intensity of 14 ft. candles being obtained. The lighting is both from the centre and sides. The centre lighting is provided by Crompton dispersive reflectors fitted with 400-W fluorescent lamps. The side lighting has been obtained by the use of Crompton elliptical angle reflectors fitted with 125-W fluorescent lamps. The fittings have a special device which permits the reflector to be adjusted without disturbing the lamp from the vertical burning position. The connecting collar between the hood and main reflector is an alloy die-casting.

In another shop, where a general lighting system is also employed, the fineness of the work carried out demanded the utmost freedom from shadows. To meet this Crompton "Glassteel" diffusers were used. These fittings, equipped with 200-W lamps, give an average intensity of 12 ft.-candles.

The electrical contractors were Rouch & Penny, the lighting units being supplied by Crompton Parkinson, Ltd.

Technical Man-Power

Meeting an Urgent Need

AT a Press conference last week presided over by the President of the Institution of Electrical Engineers (Sir Noel Ashbridge), supported by the President of the Institution of Mechanical Engineers (Mr. W. A. Stanier) and representatives of the Services, the Ministry of Labour and the Board of Education, plans for providing the necessary technically-qualified man-power for industry and the Services were discussed.

After some introductory remarks by Sir Noel Ashbridge, Mr. Stanier referred to the work of the Technical Personnel Committee and to the necessity for deciding whether young engineers could be best employed in industry or in the Forces. Requirements were becoming crystallised so that it could now be foreseen what number of men would be required during the next six or twelve months. He stressed the fact that it was imperative to provide the personnel to maintain the tools as well as the tools themselves.

Intensive training of suitable men is being instituted to enable the colossal demands of industry and the Forces for engineers to be met in the shortest possible time

Dr. A. P. M. Fleming (Engineering Advisory Committee) said that there was a threefold demand for engineers: they were wanted by industry, by the supply establishments and by the Forces. The supply was limited and had had to be thinly spread; the need for more and more men was urgent. The Technical Personnel Committee had decided to concentrate at first on the largest and most urgent need—the provision of technically-trained men for the repair and maintenance of armoured fighting vehicles and all the other military mechanical equipment which was being employed.

Hitherto an adequate supply of such men had been secured mostly from the Services themselves, partly from the yearly output of the universities and technical colleges and partly by volunteers over the age of reservation. These resources had now proved inadequate to the rapidly-expanding needs of the Services, and it had become necessary to review the cases of all those engineers in civil employment within the scope of the Joint Recruiting Boards, who were under the age of 25 when they registered for military service, with a view to recommending those who were suitable for consideration for commissions. In reviewing these cases the views of the men's employers would be taken into account. All holders of university degrees or Higher National Certificates in Engineering would be affected by this decision.

If these men were withdrawn from industry it would be necessary to replace them. In normal times, in addition to graduates in applied science, industry absorbed for training considerable numbers of young men from the secondary schools who acquired the requisite technical training by part-time study. Another class were the craftsmen who by diligent part-time study had secured the Ordinary National Certificate. The supply of the first two classes had diminished and it therefore became necessary to pay greater attention to the third class.

It appeared essential, as a wartime expedient, to give these men more intensified training and it had been decided that young engineers who possessed the Ordinary National Certificate, or comparable qualifications, would be eligible for six months' full-time intensive technical training at State expense to raise them to approximately the standard of the Higher National Certificate. This would bring to much earlier technical maturity those who took advantage of this training.

An increase in the intake of trade and special apprentices was desirable so as to ensure a supply of the "raw material" necessary for future courses of intensive training. It had to be remembered that training took time and it would be absurd to wait until the need was acute before emergency measures were taken. Industry would therefore appreciate the desirability of supporting wholeheartedly the proposed intensive training courses.

Efforts were being made in the Services to locate men who had already had such engineering training and experience as would fit them for promotion to commissioned rank and to select those men with suitable basic education and practical experience to enable them also to benefit by the six-months' intensive training course.

Further steps were being taken to ensure that technical personnel already in the Services was effectively employed and a thorough review of technical men in the Supply Departments was being carried out.

One important matter was the provision o the necessary teachers to conduct the intensive training courses and industry was being asked to make available personnel on a part-time basis to supplement the teaching staffs of technical colleges.

Full particulars of the intensive training schemes referred to are set out in a statement

by Lord Hankey, chairman of the Technical Personnel Committee, circulated to engineering firms by the Board of Education. In this it is emphasised that although the arrangement applies primarily to men with Ordinary National Certificates or other educational qualifications other workers in the engineering industry may be fully qualified to benefit by the courses.

Employees selected for training will have the status of holders of awards granted by the State and will receive, in addition to free tuition, allowances at the following rates:—£160 per annum in London and £130 per annum elsewhere if living in lodgings, and £90 per annum or £75 elsewhere if living at home. The allowances will be paid weekly by the authorities of the college at which the course is being taken. This arrangement is necessary since it may be found that some students are unable to reach the standard of work required in which case their attendance at courses would have to be terminated. A list is given of 116 colleges in all parts of the country at which courses are being provided with an indication of the branches catered for—mechanical, electrical, automobile, aeronautical and production engineering and naval architecture.

Lord Hankey appeals to industrial concerns to co-operate by releasing employees who are qualified to act as teachers, preferably those who have had some experience of teaching in evening classes.

The procedure for the recruitment of students is as follows:—Firms, after selecting suitable employees, should get into touch with the most suitable technical college and book places and give the college the students' names and addresses. If there is no college within easy travelling distance from the students' homes the firm should send to the Board of Education (Branksome Dene Hotel, Bournemouth), or in the case of Scotland to the Scottish Education Department (St. Andrew's House, Edinburgh, 1) a statement of the requirements, indicating any preference it may have for a particular college. At the same time the names and addresses of the students should be sent. As soon as sufficient applicants have been accepted to form a class (say 20 students), colleges have been asked to begin with the least possible delay.

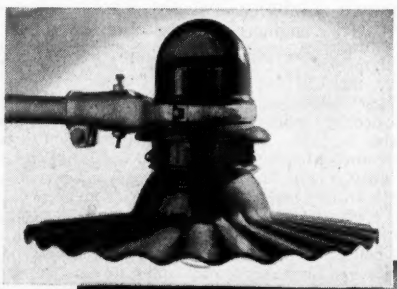
Modern American Plastics

ALTHOUGH a certain stigma attaches to the popular phrase, it is sometimes possible to make a real virtue of a necessity, particularly in the matter of plastic substitutes for metals. The United States, like ourselves, finds it essential to restrict the use of metals for purely civilian purposes in order to carry out orders for the military, naval and air forces, and in consequence much ingenuity is being exercised in finding suitable substitutes.

Some excellent examples of these were submitted on the occasion of the recent Sixth Annual Modern Plastics Competition, and we reproduce illustrations of two of them.

The first is a novel "radial wave" street lighting reflector for which the American General Electric Co. was awarded a prize. The material is laminated and the reflector consists of a phenolic "Textolite" base on to which an alkyd resin finish is baked. The top is green and the underside white. The reflector is 20 in. in diameter and incorporates a copper collar for easy installation. The fitting can easily be recoated when it becomes necessary.

The other example is a design of "streamlined" torch, produced by the Gits Molding Corporation. The shell is injection moulded in red, blue and black, and is reinforced with nine fins, and there are metal rings at each end of the battery chamber and a connecting copper strip to which a switch is attached. The non-breakable switch is threaded for ease of assembly.



Left: A moulded street lighting fitting. Below: "Streamlined" torches

Maximum Demand Metering

Anomalies of Definition and Measurement

By D. J. Bolton

ONE of the main factors in the development of engineering from the merely descriptive science of the early pioneers has been the ability to measure. Once the quantitative basis was established, engineering could be said to have begun. Electrical engineering, the latest of the many branches, has well maintained the tradition thus started, and its processes are metered at every stage with a very high degree of precision. Even the mysteries of prediction involved in design and in the predetermination of performance are carried through on electrical plant without the need of too large a margin of "factor of ignorance."

The author points to deficiencies in the Merz and Wright systems of m.d. measurement and suggests discrimination and modifications in their use for different purposes

In the realm of supply this high standard of precision is, for the most part, well maintained. The principal quantity concerned is energy, and the AC energy meter is probably unequalled at its price in any sphere of measurement whatsoever for sustained accuracy, robustness and life without attention. Unfortunately energy, though the chief, is not the only quantity concerned; and when we look at some of the others we find the high traditions have come down with a bump. What would be said of a grocer who weighed out his butter on a chemical balance and made out his bill correct to one part in 10,000, yet when it came to bacon charged quite a different price if one bought at 3 or 3.30 p.m. from the price charged at 3.15. Yet this is almost literally what happens with a maximum-demand tariff.

A "Horrible Example"

An actual and recent example was a two-part tariff for bulk supply at a number of points, the running charge being given as 0.187756d. per kWh. The fixed charge was metered on thermal indicators which could not be read nearer than about 2 per cent., and whose values could always be changed by some 3 per cent. merely by tapping the instrument. Moreover they were reading a quantity quite incapable of definition since it depends on an indeterminate time lag. At first sight a running charge of six-figure accuracy seems merely silly, though it must be realised that, read every month at a number of different points, the aggregate might conceivably have an accuracy which would justify some four or five significant figures. What made it silly was its conjunction with a highly ambiguous demand charge.

If the quantity which is thus liable to be defined so vaguely and measured so ill were unimportant one could understand the point even though not approving it. But maximum demand is a highly important quantity and large sums depend upon its determination. Most public supplies in this country are metered at least once (often several times over) on a two-part basis, and something over half the cost is in fixed charges. The Central Electricity Board has an income from fixed charges alone of some £16 to £20 million per annum, and the total dependent on maximum-demand readings must be several times this. A variation of one per cent. in these readings therefore means an annual sum of, say, half a million pounds.

The lack of precision in maximum-demand measurements cannot, however, be blamed entirely or even chiefly on to the measurement engineer. There is as much or more vagueness about what is to be measured as there is in the measurement thereof. Even the nomenclature has not been standardised, and before proceeding further it will be well to define two terms as follows:—

Integration Period.—The duration of the successive equal intervals of time (*e.g.*, 30 min.) during which the power, kilovolt-amperes or other quantity is integrated for the purpose of determining the maximum demand.

Assessment Period.—The prescribed period (*e.g.*, a year, a quarter or a month) within which the maximum demand is measured.

With most measurements there may be variations in the quantity itself and there may be inaccuracies in the meter, but there is nothing much that can go wrong in between. But with maximum demand, even if one starts with a fixed shape of load curve and finishes with a perfect measuring instrument there is a loose connection between them, affected by any of the following variations:—

Variables in the Integration Period.—Length of Period: Whether 15, 20, 30, etc., minutes. Type of Period: Whether of the "floating time lag" (Wright) type, or of the block interval (Merz) type in which the quanta of energy are cut off like so many lengths of ribbon, each unaffected by its predecessors. In the latter case there is a further variable:—Timing of period. Whether starting at the hours and half-hours, and how related to the load-curve timing.

Variables in the Assessment Period.—Length of Period: Whether the year, the quarter or

the month. Character: As an alternative to a strictly annual assessment (based on the single highest reading in the year) the reading may be taken only in the four winter months and the assessment based on the highest of these. Or it may be on a monthly basis so long as the demand is rising during the year, and based on the highest previous reading when the demand is falling (statutory average m.d.).

It is clear that the size of the fixed cost will be affected by the plan adopted on each of the above points, but just what degree of difference will result has never been adequately investigated. The inquiry described below refers to two only of these variations, namely, the timing and length of the integration period.

Timing of Period

Fig. 1 shows the peak portion of a load curve for a small group of domestic consumers.

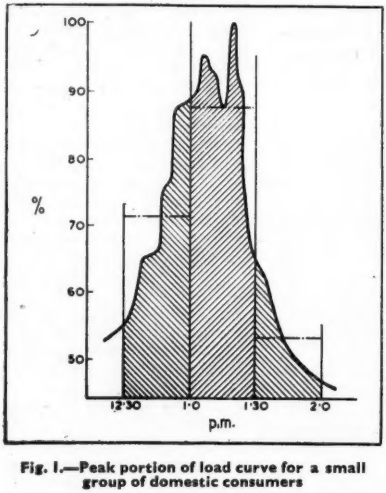


Fig. 1.—Peak portion of load curve for a small group of domestic consumers

Uprights are drawn at 12.30, 1.0 p.m., etc., and chain dotted horizontals show the mean power during these half-hour periods. Under the standard Merz system the demand mechanism will be driven to points representing these heights, and the largest will be the m.d. recorded. Now imagine these uprights to travel across the graph; the mean heights of each column will be affected, including that of the largest (*i.e.*, the m.d. reading). When the uprights have travelled across by half-an-hour all possible variations will have been explored.

In the case shown, if the maximum or "floating half-hour" (*i.e.*, the largest power averaged over any consecutive thirty minutes) be denoted by 100, the smallest half-hour reading is 13 per cent. less, and the true (instantaneous) maximum is 9 per cent. more. The particular reading obtained when the periods start at the hours and half-hours will depend on the position of the peak relative to the clock times—*i.e.*, it will be an accidental value ranging between 87 and 100.

An Element of Luck

This particular load curve is unusually peaky for a group curve although not for a small individual consumer. In the case of six different load curves whose peaks were analysed in this way the maximum variation due to clock timing ranged from 30 per cent. in the case of a single industrial consumer with a highly fluctuating load to 1½ per cent. in the case of an aggregate grid load.

It will be seen that even with a fixed shape of load curve and an agreed definition and measurement of maximum demand there is an element of luck in the actual figure recorded. Perhaps one should welcome this spice of pure chance cutting across the sober certainties of supply accounting. Sporting events are now rare, and when one of the protagonists is an official body like the C.E.B. the affair almost takes on the dignity of a State lottery!

But how if the lottery can be "got at" and becomes a game of skill and cunning rather than a game of chance? Visualise in the future the building-up by undertakings of "controlled load," consisting of water and space heating governed by superimposed signals, and sold on a tariff permitting temporary suspension of supplies. With the present metering, such a load offers scope for what might almost be called sharp practice on the part of the purchasing engineer with a careful eye on the clock.

The selling authority might counter the attack by developing a meter which recorded the "floating" half-hourly demand by mechanical registration. Each minute it would add to its record the consumption during that minute and subtract the consumption during the corresponding minute half-an-hour back. Such a meter could hardly be cheap enough to use on consumers' premises but it might be justified for bulk supplies. It is true that the thermal m.d. indicator already does something of this kind, but unfortunately what it does cannot be stated (and still less executed) with the precision that a large contract necessitates.

Length of Period

The second variation to be studied is the length of integration period. Consider a triangular peak whose apex falls within the particular integration period which is determining the maximum demand. Let l be the length of the integration period, and let l be varied (fig. 2). The m.d. reading will be the mean height of the area enclosed between the two timing ordinates, and this area can be considered as made up of two vertical slices. The mean height of the slice X A B Y will be Y Q where Q is the mid-point of B N, and the

mean height of the slice Y B C Z will be Y P where P is the mid-point of B M.

As *l* increases, both these mean heights will decrease and hence so will the mean height of the whole figure. The rates of decrease will depend on the slopes of A B and B C and on the proportions of the two slices, *i.e.*, on the position of the peak point B within the two timing ordinates. In the extreme case of a rectangular peak of duration less than *l*, flanked by zero load on either side, the m.d. reading will be inversely proportional to *l*.

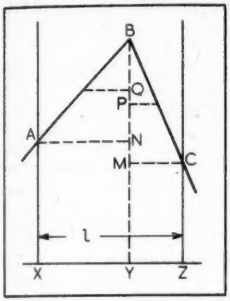


Fig. 2.—Maximum demand in varying integration periods

Certain things follow from the above. Unless the peak is flat topped for at least *l* minutes any increase in *l* will reduce the m.d. reading. The rate of change will depend on the steepness of the sides of the peak. Provided only one peak is involved the variation will be continuous, but if the increase in *l* results in the inclusion of secondary peaks the function will be discontinuous. There may then be values for which an increase in *l* gives a temporary increase in the m.d. reading.

This hypothetical examination is chiefly useful as a guide to the limits of possible variation. Just as in the case of timing changes, the actual variation will entirely depend on the shape of the load curve in the neighbourhood of the peak. In order to obtain some idea of what variations could be expected in practice, the six load curves already mentioned were analysed for changes in length of period. The ordinates were tabulated and then taken in groups of 5, 10, 15, 20, 30, 40 and 60 consecutive minutes. All groups were arranged to commence at 12 o'clock and corresponding subsequent clock times. The sum of the ordinates in each group divided by the size of the group then gave the demands which would have been recorded. The largest of these for each length of period constituted the m.d. reading required.

Expression of Results

Starting with the instantaneous (*i.e.*, one-minute) reading, the effect of extending the integrating time to a longer period was then expressed as a percentage reduction from the one-minute reading. Leaving out the first and last curves, neither of which represented a usual situation, it was found that the results could be expressed approximately as $r = Ct^{0.6}$, where *r* was the percentage reduction in reading for an integration time of *t* minutes, and C was a constant ranging from 0.6 to 1.6.

Such a formula could be used as a rough guide to the change in registration to be expected from a given change in integration periods. Thus suppose the period is being changed from 15 minutes to 30 minutes, and that the load curves are estimated to be of a degree of peakiness represented by a value for C of 0.7. Then the difference in percentage reduction $r_1 - r_2 = C(t_1^{0.6} - t_2^{0.6}) = 0.7\ (15^{0.6} - 30^{0.6}) = -1.8$ per cent. It would be sufficiently near to take the reductions as being percentages of the 15-minute values rather than of the instantaneous values and say that there will be a 1.8 per cent. reduction in registration due to a change from 15- to 30-minute integration periods.

Conclusions

It will be seen that the Merz system measures a precise and well-defined quantity, but it is not exactly the quantity we wish to measure. Its relation to the load curve is to some extent accidental and ambiguous, and its relation to the supply plant is even more exiguous. Although the half-hour period may represent a logical basis for fixed-costs charging (corresponding to the overload capabilities of much of the plant) there is no special logic in starting the periods at particular clock times, and still less for commencing each period afresh without reference to what has gone before. The heating of an alternator or cable does not come on in half-hour blocks and return to zero when the clock strikes the hour.

The alternative (Wright) system is more logical because it uses a thermal instrument as a guide to the heating of the plant. It also greatly simplifies metering when power factor penalties are to be levied in the form of a flat rate per kVA. On the other hand it suffers from very serious uncertainties of definition and measurement.

The present writer's solution would be to use the Merz system on all bulk supplies and large contracts, the power factor being independently metered when required. For small industrial or commercial consumers on a kVA tariff, the thermal instrument should be used *with multiple readings*. The fixed charge, that is, should be based not on a single yearly maximum but on the mean of a number of readings, with a corresponding increase in the magnitude of the charge.

Even if the readings were all taken at the same period (*e.g.*, twelve readings during the four winter months) the mere fact of their number would have two important advantages. It would divide by twelve all the variations studied above, and it would put the metering more in line with the costs. For it is obvious that (other things, *e.g.*, time of year, being equal) the consumer who habitually overloads is more expensive to supply—because he has less diversity—than one who overloads only once in the year. Similar arguments (for

multiple reading) could, of course, be advanced for the larger contracts except that, their curves being less peaky, the variations here studied are smaller.

Metering and Plant Capacity

In the above discussion of the effect of length of integration period the matter is regarded purely from the metering aspect. An endeavour is made to see how the m.d. record would vary with the length. There remains the broader aspect, namely whether the present practice of half-hour lengths is really the best for the purpose we have in view. For since the object of m.d. metering and tariffs is to levy a charge dependent on the amount of plant utilised there should evidently be some correspondence between demand metering and plant capacity.

At any particular moment the capacity of a supply system is probably limited by a " bottleneck " at some one point. But in the long run, and with a growing load, sooner or later each plant item in turn must be supplemented or replaced by a larger one. As regards the electrical plant, the factor which limits its capacity is almost invariably temperature rise, resulting from the losses. It is extremely difficult to generalise about the behaviour of such plant on a fluctuating load. On the one hand the plant itself varies greatly in size and therefore heat capacity, and in the proportions of fixed and variable losses. On the other hand there is the infinite variety of possible load curves. If, instead of generalising, one makes actual tests one must decide what is a typical type and size of plant, and what is a representative load curve.

In the case of two of the (relatively peaky) load curves referred to above, tests were made on a 75-kVA transformer and a number of m.d. indicators by passing through them a loading cycle based on the shape of the curve. The results seemed to show that for this size of plant (and therefore for anything larger) neither the " floating time-lag " of the thermal instrument nor the 30-min. average of the block interval type was any guide to plant temperature. Peaks of half-hour and one-hour duration produced only minor temperature rises in the transformer, and from this point of view a two-hour integration period would appear to be more suitable. Tests on a cable would no doubt tell quite a different story, and moreover with lines and cables (in which so large a proportion of the capital is sunk) there is the regulation limit which is a short-time phenomenon.

Apart from questions of thermal capacity of plant there is a very definite reason why integration periods should be longer, a reason connected with diversity. Diversity is usually taken as a constant overall figure for costing purposes, and it would then not affect the metering argument, but actually diversity represents a variable link between individual demand and system demand. I have used the term " differential diversity " to describe the inverse relationship between diversity factor and load factor, which might be expressed in this case by saying that there is a greater *probability* of diversity between a number of half-hour loads than between a number of one-hour loads. (In the extreme case, a 24-hour load on the day of peak admits of no diversity whatever.) Hence a one-hour peak should (other things being equal) be charged more than a half-hour peak since there is more likelihood of its overlapping other demands.

Repetition Welding

PROVIDED the metal is of a suitable thickness and the output is high, automatic arc welding (in which repetition of a pre-set operation is carried out by press-button control) is applicable to many more jobs than is sometimes supposed, with consequent great savings in speed and labour.

Data in support of this claim are contained in the Eastern Regional Bulletin (No. 62) of the Ministry of Supply. An example is the welding of 20,000 units involving 400,000 ft. of weld. One operator could complete the work with an automatic machine, welding at 2 ft. per minute, in 3,400 hours at a cost of £255 for labour, at 1s. 6d. per hour, and £1,318 for the continuous electrode, giving a total of £1,573. For the manual process eight men at 2s. per hour would be employed for the same number of hours at a cost of £2,720; adding £1,075 for hand electrodes would bring the total to £3,795.

The higher cost of the continuous electrode is largely offset by saving in tip wastage. Also less electricity is consumed in the continuous automatic process than in hand welding, in which the plant is idling for upwards of 50 per cent. of the working period. In addition there are the savings in overhead charges that result from reduced labour and floor area.

The appended table gives examples of speeds of automatic equipments in the butt-welding of various thicknesses of plate. In each case full root penetration was obtained in one run.

Plate thickness, inches	Preparation	Ft. per hr.	Electrode SWG	Welding amperes
1/4	Square butt	120	8	280
3/16	Square butt	110	8	300
1/4	Square butt or 45 deg. V with 1/32 in. gap	80–60	8	380–300
5/16	45 deg. V with 1/16 in. gap	60–50	6 or 8	420–350
3/8	45 deg. V with 1/16 in. gap	50–45	6 or 8	450–400
1/2	35 deg. V with 7/64 in. gap	45–40	Twin 8	600–500

PERSONAL and SOCIAL

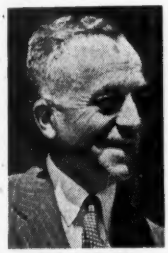
News of Men and Women of the Industry

OWING to ill-health, **Mr. W. S. Johnston,** borough electrical engineer, St. Helens, has tendered his resignation to take effect on April 1st, 1942, Mr. Johnston has held the position for fourteen years.

Capt. J. C. H. Tucker was married on November 29th at Knowle Parish Church to Miss Susan Browne-Bagshaw. Capt. Tucker, who is staff captain R.A.O.C. attached to War Office, is the only son of Mr. J. B. Tucker, managing director of J. H. Tucker & Co., Ltd., and the Kersons Manufacturing Co., Ltd.

Major E. Cadbury has been appointed Regional Fuel and Power Controller for the South-Western Region, and **Mr. H. C. Walker** has been appointed Deputy Regional Fuel and Power Controller for Wales with special responsibilities in North Wales.

Mr. J. Mould, chief electrical engineer of Leicester, has been elected chairman of the National Gas and Electricity Committee in succession to Mr. R. Foot, who was recently appointed to a post with the B.B.C. Mr. Mould has been vice-chairman of the Committee since its formation and is succeeded in that position by Mr. E. V. Evans.



Mr. J. Mould

Mr. L. H. Thompson, chief costs clerk in the Watford Electricity Department, has been appointed chief accounting officer in the Derby Electricity Department. **Mr. F. Mosley,** senior accountancy assistant, Hull Corporation Electricity Department, has been appointed chief clerk in the Watford Electricity Department.

Owing to the increase in numbers in the Electrical Engineering Department of the Liverpool Technical College, **Mr. R. Rankin,** electrician, has been appointed instructor. **Mr. S. W. Scott,** lecturer, is appointed senior assistant with special responsibility for day apprentice work, and **Mr. J. Thomas,** lecturer, is given special responsibility for the radio laboratory.

Mr. W. H. Hancock, who for the last eight years has been borough electrical engineer of Conway (North Wales), has resigned in order to take up another appointment. The Corporation is advertising the vacancy. The position carries a salary of £450 per annum.

At a recent meeting of the Chemical Divisional Council of the B.S.I. **Dr. F. F. Armstrong,** F.R.S., who has been chairman of the Divisional Council since its formation about ten years ago, retired from the chairmanship and **Mr. Roger Duncalfe,** president of the Association of British Chemical Manufacturers, was appointed to succeed him.

Mr. J. W. Donovan has been nominated for the presidency of the Birmingham Electric Club for 1942, with Messrs. A. M. Fletcher and A. T. Haywood as vice-presidents and Messrs. J. H. Asdell and J. E. Oakley as hon. secretaries. The annual general meeting of the Club on December 19th is to be followed by a luncheon and re-union. During the past year there were nine new members, six died and 25 resigned, making the membership 418. Annual educational prizes have been awarded as usual and 80 parcels of tobacco have been sent to serving members.

Obituary

Mr. H. H. Reynolds, M.I.E.E., M.I.E.(Ind.), whose death on November 16th, at the age of 69, was announced in our last issue, was educated at Kent House School, Eastbourne, and served a three-year pupilage with Crompton & Co., Chelmsford. Afterwards Cromptons sent him to Cork and Yarmouth in connection with town lighting schemes which they were laying down, and subsequently, in 1896, he went to Calcutta where he joined the firm of Kilburn & Co., managing agents of the Calcutta Electric Supply Corporation, and was responsible, under Mr. Scott Moncrieff, for the first power station erected in Calcutta, at Emanbagh Lane.

Subsequently Mr. Reynolds started in practice on his own account in Calcutta as a consulting engineer, and in 1915 he was engaged by Andrew Yule & Co., Calcutta, as consulting engineer for their large group of collieries. He remained with that concern until he retired from India in 1933.

Mr. James E. Rawson, electrical engineer to Todmorden Corporation, died suddenly on December 4th, at the age of forty-five years. It was only in July last that Mr. Rawson succeeded his chief, Mr. E. Brunt, upon the latter's retirement. He had been at Todmorden since 1915 and was mains superintendent for 21 years.

Still More Paper

THE turn of events during the past few days has endowed the subject of paper salvage with even greater importance than before and therefore we do not hesitate to reiterate the appeal which we have been making for the last month or so.

We ask all companies, firms and individuals in the various branches of the electrical industry to take every step possible to return to the mills every piece of paper which has served its immediate purpose. An amazing amount can be collected by a determined effort—an effort which is worth making and, indeed, must be made.

A good electrical example (in a double sense) is reported in the December "A.E.I. News." Several tons of old records, documents, and books of the Metropolitan-Vickers Electrical Company's Patent Department in London have been removed from a vault which the company used in a safe deposit in the City, badly damaged in an air-raid, and sold to a firm of waste paper merchants. The money received has been given to the Red Cross.

May we repeat some advice given in an earlier issue? Everybody's business is nobody's business, and so to ensure results every firm should delegate the task of collection and disposal of waste paper to an individual with sufficient authority to decide or suggest what paper is no longer required and can be used for the production of munitions.

The Australian Market

Official Figures of Production and Imports for 1939-40

THERE have been made available in Australia some preliminary figures regarding the manufacture of electrical machinery and apparatus in the Commonwealth in 1939-40. Presumably because of the wartime ban on the issue of statistics likely to aid the enemy, the details are not complete, but in spite of certain gaps they present an interesting picture of the progress made.

The aggregate value of the production of these goods in 1939-40 was £A7,456,000 compared with £A6,954,000 in the preceding twelve months. Particulars of the number (where shown) and the value in the two periods are given in the following table:—

	1938-39 Number	1938-39 £A	1939-40 Number	1939-40 £A
Dynamos—				
Alternators ..	72	4,517	259	13,950
Generators ..	455	13,092	433	12,716
Motors—				
A.C.	31,332	319,104	37,428	410,492
D.C.	304	33,686	648	67,347
Transformers and convertors—				
Above 20 kVA: For use in supplying industrial power and light	1,712	341,773	1,424	313,011
Below 20 kVA: For use in neon signs	13,228	28,428	10,057	28,158
For use in radio and electrical toys	23,264	9,330	31,993	15,594
For industrial use other than the supply of power and light ..	9,779	42,862	14,835	74,090
Accumulators (automobile, radio) ..	475,033	615,011	474,188	533,317
Apparatus for telegraphy and telephony	—	60,841	—	65,757
Apparatus for regulating, starting and controlling ..	—	536,548	—	594,808
Household appliances (not exceeding 33 lb.)	—	48,119	—	54,167
Electrical appliances and apparatus for motor vehicles, cycles, etc. ..	—	37,388	—	40,482
Stoves, ranges and cookers	—	153,000	—	32,073
Other domestic cooking apparatus	—	119,412	—	151,152
Refrigerators ..	—	—	13,541	474,739
Heating apparatus	—	192,518	—	217,492
Neon signs, etc. ..	—	466,818	—	473,264
Other electrical articles	—	3,270,128	—	3,544,000

It will be seen that the manufacture of dynamos, although still quite small, progressed in 1939-40, while that of motors reached nearly £A500,000 in value. That transforming and converting apparatus made a noteworthy advance is evident, although the figures for 1939-40 are incomplete, and the same remarks apply to battery manufacture. Some of the totals of the smaller apparatus, *e.g.*, refrigerators and neon signs are striking, but here again comparative figures are not in every case available.

It is impossible at present to estimate the influence that this development will exercise on the future of United Kingdom electrical exports not only to the Commonwealth but also to New Zealand and the Pacific Islands, where Australian electrical exporters are already competing, and to Malaya, India and South Africa, where they hope ultimately to extend their sales.

The need to economise in shipping and to satisfy requirements east of Suez by means of every available source of production in the same geographical sphere is all that matters. When Axis aggression is finally checked such subjects as the allocation of primary production and secondary industry as between the various parts of the Empire will no doubt come up for serious discussion. By then new and valuable experience of manufacturing costs and marketing possibilities will have been gained by British concerns which have been producing both at their parent works at home and at their branch factories overseas.

Import and Export Trade

Statistics of a number of the main groups of electrical imports have been issued for 1939-40, and are appended with a note of the difference as compared with 1938-39. Apart from an increase in covered cable and wire nearly all the items show decreases, but it cannot be said to what extent the declines are attributable to the growth of local manufacture, or to what extent they have been occasioned by wartime difficulties:—

	1939-40 £A (000)	Inc. or dec.
Cable and wire, covered	1,780	+234
Carbon manufactures	154	+ 48
Circuit-breakers	76	−213
Dynamo-electric machines	670	−162
Switches, fuses, etc.	147	− 35
Lamps, filament, for lighting and heating	261	+ 48
Measuring and recording instruments ..	172	− 22
Motors under 1 HP	256	+ 41
Regulating, starting and controlling apparatus	165	− 58
Static transformers and induction coils, etc.	66	− 34
Telephones	183	+ 59
Telephone switchboards, telephone distributing boards, etc.	684	−497
Other electrical machinery and appliances	421	− 47

In the export of electrical machinery and equipment of Australian manufacture there was a slight decline in 1939-40 compared with the two preceding years. In that year the total value was £A346,565. In 1938-39 it was £A392,630 and in 1937-38 it was £A518,400.

Impedance Losses

Effect of Temperature Variation in Transformers

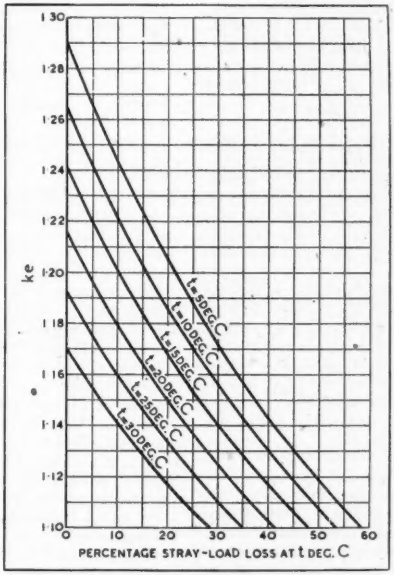
By M. Nicholson-Steng,
Grad.I.E.E.

THE transformer losses here dealt with are those incidental to the carrying of load and usually referred to as load losses. They are demonstrated on test by passing rated current through a transformer with its secondary short-circuited. The voltage and watts input necessary for this purpose are the impedance volts and the impedance watts. The term "copper losses" often applied to the watts given by this short-circuit test is not strictly correct.

Impedance losses in a transformer are made up of :—(*a*) the I^2R losses in the windings as for direct current; (*b*) the eddy - current losses in the loaded windings caused by the alternating leakage flux cutting the conductors; (*c*) hysteresis and eddy-current losses in the tank, clamps and core plates set up by the alternating leakage flux cutting these portions of the transformer structure.

In Appendix D of B.S.S. 171/1936 impedance losses are grouped together as :—(1) direct load loss = I^2R loss in primary and in secondary; (2) stray load loss = stray load loss in conductors and stray load loss in other parts. The same Specification stipulates that for the calculation of efficiency, regulation and percentage impedance, all load losses shall be computed for a mean temperature of the windings of 75 deg. C. Test-room temperatures may in this country vary over a range of from approximately 5 to 30 deg. C., and it is therefore desirable to have a method of changing load losses at one temperature to their equivalent at another temperature. This is also required for other reasons, an important one being the predetermination of the behaviour of a transformer under transient loading conditions.

First in importance of the constituent parts of the impedance losses comes the direct-load loss, because in a well - designed transformer it is generally the greatest. This is the I^2R loss in the windings calculated from the DC resistance and their corresponding currents. The resistance of copper over the range of temperature met with in practice varies in direct proportion to the temperature above −234.5 deg. C. Therefore direct load loss = I^2R loss at $T = 234.5 + T$ / I^2R loss at $t = 234.5 + t$ where T is the temperature (in deg. C.) to which the losses are to be converted and t is the temperature at which the losses are known.



Conversion constants (ke) plotted against percentage stray-load loss at various temperatures

The next losses to be considered are those due to eddy currents in the loaded windings. These are caused by the leakage fields of the transformer cutting the individual conductors, thus causing circulating currents to flow in them and set up parasitic losses. The e.m.f. causing the eddy currents is not affected by temperature variation.

The resistance of the circuit through which these currents flow, however, varies in direct proportion to the temperature and so eddy-current losses vary with the temperature inversely as the variation in resistance. Therefore

$$\frac{\text{Eddy-current losses at } T}{\text{Eddy-current losses at } t} = \frac{234.5 + t}{234.5 + T}$$

The last type of load losses to be considered are those due to hysteresis and eddy currents in the tank, clamps and core plates. These are akin to an iron loss, the magnetising current causing the leakage flux flowing in the windings or electrical circuit, the flux thus set up passing through the iron path provided by the tank, etc. It would be reasonable to suppose these losses to be unaffected by temperature as is the normal iron loss. Actually the variation due to temperature of

such losses seems to be wrapped in mystery.

In Appendix D of B.S.S. 171/1936 eddy-current or stray-load loss in windings, together with the losses which have just been considered (those referred to as "stray-load loss in other parts") are grouped together under the title of stray-load loss. The Specification states that load losses shall be corrected to the reference temperature of 75 deg. C. on the assumption that the direct load loss (I^2R loss) varies with temperature directly as the variation in resistance and that the stray-load loss varies with temperature inversely as the variation in resistance.

No attempt is made to differentiate between the stray-load loss due to eddy currents in the windings and that due to leakage flux cutting the structural steelwork and core-plates. The conclusion to be drawn is that for the purpose of this Specification it is assumed that the latter is varied by temperature in the same way as the loss due to eddy currents in the windings.

Measurement of Losses

Load losses of a transformer as a whole may be measured by a wattmeter at rated frequency if sufficient voltage is applied to one winding to produce full-load current when the other winding is short-circuited. Owing to the impedance voltage the core is partly excited and the wattmeter reading therefore includes a small iron loss.

This iron loss may be measured by applying to one winding the impedance voltage of that winding, the other winding being open-circuited. The loss indicated by a wattmeter in this test should be subtracted from the losses given by the impedance test to obtain a more exact figure for the impedance losses, although the losses to be subtracted are often so small as to be negligible.

The direct-load and stray-load loss components of the impedance loss can be segregated by subtracting from the impedance loss the I^2R losses of the two windings calculated from the ohmic resistance measurements (corrected to the temperature at which the impedance losses were taken) and the currents used in the impedance tests. This subtraction gives the stray-load losses. Thus if R_1 and R_2 are the resistance values of primary and secondary windings at the temperature at which the impedance test was taken and I_1 and I_2 are the primary and secondary current values then the stray-load loss = total impedance loss $-$ $(I_1^2R_1 + I_2^2R_2)$. Stray-load loss is often expressed as a percentage of direct-load loss.

A constant ke can now be calculated for converting load losses at t to load losses at T. Let Wr be the total direct-load loss or I^2R loss at t in watts and let x be the total stray-load loss at t expressed as a percentage of the I^2R loss at that temperature, then the total stray-load loss in watts at $t = \frac{x.\mathrm{Wr}}{100}$ therefore total impedance losses in watts at $t = Wr + \frac{x.\mathrm{Wr}}{100}$. The direct-load loss at T is the I^2R loss at $T = \frac{\mathrm{Wr}\,(234.5 + T)}{(234.5 + t)}$ watts.

Assuming, as in B.S.S. 171/1936, that all the stray-load losses vary with the temperature inversely as the variation in resistance, we may substitute for "eddy-current loss," stray-load loss and write: Stray-load loss at $T = \frac{x\mathrm{Wr}}{100}\left(\frac{234.5 + t}{234.5 + T}\right)$ watts. Now . $ke = \frac{\text{load loss at } T}{\text{load loss at } t} =$

$$\frac{\left\{\mathrm{Wr}\left(\frac{234.5+T}{234.5+t}\right)\right\} + \left\{\frac{x\mathrm{Wr}}{100}\left(\frac{234.5+t}{234.5+T}\right)\right\}}{\mathrm{Wr} + x\frac{\mathrm{Wr}}{100}}$$

In order to give good results on a 12-in. slide rule this formula can be written:—

$$ke \times \left(1+\frac{x}{100}\right) = \left\{\frac{234.5 + t}{234.5 + t} + \frac{(234.5 + T) - (234.5 + t)}{234.5 + t}\right\} + \frac{x}{100}\left\{\frac{234.5 + T}{234.5 + T} + \frac{(234.5 + t) - (234.5 + T)}{234.5 + T}\right\}$$

which can be expressed as

$$ke = 1 + \frac{(T - t)}{1 + \frac{x}{100}}\left\{\frac{1}{234.5 + \mathrm{t}} - \frac{\frac{x}{100}}{234.5 + \mathrm{T}}\right\}$$

In the accompanying graph values of ke related to a final temperature of 75 deg. C. are plotted against percentage stray-load loss for values of t likely to be met with in practice. As an example of the use of this curve we may take the case of a 1,000-kVA 10,500/440-V transformer connected delta/star which gave the following results on test. Impedance watts, as measured by a wattmeter in the test room, at 20 deg. C. were 8 640 W with 55A in the primary lines. Resistance per leg of the high-voltage winding at 15 deg. C. = 1.195Ω. Resistance per leg of the lower-voltage winding at 15 deg. C. = 0.000716Ω.

It is required to find the load losses at 75 and 95 deg. C. mean temperature of the windings. At 20 deg. C., resistance per leg of the high-voltage winding = $1.195\left(\frac{234.5 + 20}{234.5 + 15}\right)$ = 1.22Ω and of the lower-voltage winding = 0.00073Ω. High-voltage current per leg = $\frac{1{,}000{,}000}{3\times 10{,}500} = 31.7$ or $\frac{55}{\sqrt{3}}$ A and lower-voltage current per leg = $\frac{1{,}000{,}000}{\sqrt{3}\times 440} = 1310$ A. I^2R loss in watts for the three legs of the lower-voltage winding = $3 \times 1310^2 \times 0.00073 = 3{,}750$ and of the high voltage winding = $3 \times 31.7^2 \times 1.22 = 3{,}680$, giving a total direct-load or I^2R loss at 20 deg. C. of 7,430 W. Stray-load loss at 20 deg. C. = 8,640−7,430 = 1.210 watts. Percentage stray-load loss when t is 20 deg. C = 16.3. From the graph, the value of ke =

INSTITUTION PROCEEDINGS

Colliery Installations. Responsibilities of Technicians.

Mining Equipment Standardisation

EXAMINATION of the scope for reducing the existing variety in which articles forming part of typical colliery electrical installations are now generally demanded was the object of the paper by Mr. J. A. B. Horsley (formerly Chief Electrical Inspector, Mines Department) submitted to the Installations Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on December 11th.

Rationalisation of mining equipment to the stage of allocating products to particular manufacturers was rejected as impracticable in the existing organisation of industry. Instead, reduction of variety on the basis of British Standard Specifications was discussed, and with respect to certain apparatus for which standards had not yet been instituted.

Existing Specifications

Many of the B.S. Specifications were applicable, wholly or in part, to electrical plant used in coal mines, both above and below ground. Of the fourteen prepared expressly for mining requirements, two were of special character, three limited variety more or less, four imposed dimensional limits with or without identity dimensions and five were concerned with general construction with or without limitation of variety. Dimensional identity was suggested for components which for practical convenience should be interchangeable, such as flameproof plug-and-socket couplings; also the scope for a large reduction in variety of sizes and types of cable, both flexible and armoured, was pointed out. The markets for both these classes of goods were limited and the total annual demands could be estimated with considerable accuracy.

The advantage of restricting the number of sizes and varieties of cover glasses for flameproof lighting fittings should be evident, because the peculiar characteristics required of them necessitated a special technique in their their manufacture. No limitation had been attempted, nor any endeavour to make cover glasses (well or bulk-head) interchangeable for any one size. The relevant B.S.S. was simply a prescription of quality, indirectly by requiring impact and other tests. The use of such cover glasses was not confined to mining, in which the demand for them was relatively small and limited to the lower ratings, but there was a growing industrial market for them in situations where there was an explosion hazard.

In commenting upon the lack of any agreed standards of speed in relation to output for certain stock types of motors, the author pointed out that the variety offered was at present limited only by the range of frame sizes and number of poles for which they could be wound. Further duplication was caused by the availability of either squirrel-cage or slip-ring machines, although the latter did not appear to be necessary except for particular duty (rope haulage) requiring controlled acceleration. When the motor with its switchgear was an integral part of a complete machine (coal cutter and some conveyors) the design had evolved from a process of trial and error, and the machine was sold on its practical performance rather than on the electrical rating of the driving motor. While the design of such machines remained in the evolutionary stage any nearer approach to standardisation was probably impracticable.

Cable Variety

Other examples chosen to illustrate existing heterogeneity where homogeneity would seem to be practicable and advantageous included couplings and terminal boxes for armoured cables, relevant specifications permitting a choice of 266 varieties of three-core cable in three voltage groups of 650/3,000/6,000 V, while there was no B.S.S. for other kinds of cable employed in mines. Lack of data regarding the sizes and varieties most in demand prevented the author from making specific proposals for curtailment, but at least the respective fields of application of cable insulated with paper and rubber compound could be delimited on the basis of voltage with advantage to user and manufacturer.

It should be possible to standardise two values of resistance for mine signalling 25-V bells and one value of resistance for associated relays; also to limit the manufacture of the present three types of spark-suppressing devices to one. The variety of 30-V interlocking circuits employed in contactor type gate-

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Impedance Losses (*Concluded from page* 672)

1.161, so that the impedance losses for a mean temperature in the windings of 75 deg. C. = 8,640 × 1.161 = 10,020 W.

For a mean temperature in the windings of 95 deg. C, $ke = 1 + \frac{(95-20)}{1+\frac{16.3}{100}}\left\{\frac{1}{234.5+20}-\frac{\frac{16.3}{100}}{234.5+95}\right\} =$

$1+\frac{75}{1.163}\left\{0.00394-0.000495\right\} = 1+64.5\times 0.00345 = 1.222$, so that the load losses were 8640 × 1.222 = 10,650 W at that temperature.

end switch boxes for remotely controlling coal cutters caused much inconvenience.

Lack of any standard colliery voltage was a serious obstacle to complete standardisation of three-phase plant; voltage was not even standardised for any one colliery and some of them were still operating at non-standard frequencies.

Technicians and Society

THE annual Students' Lecture arranged by the INSTITUTION OF ELECTRICAL ENGINEERS was delivered at the North Midland Centre at Leeds on December 6th by Dr. D. S. Anderson, principal of the Central Technical College, Birmingham. He spoke of "the failure" of the technician in his role as citizen; his brilliant performance had been creating problems, both industrial and social, faster than the community could solve them. His responsibility for trying to find some solution must be greater than that of his fellow citizens, for he had created the problems; the post-war attack upon them would need to be concerted and seriously made.

After briefly outlining standard theories relative to unemployment, and possible lines of action for its minimisation, the lecturer pointed out the absurdity of organising for war while neglecting to do so for peace. His case for a vigorous planning policy led to the suggestion of a board to control the release and development of inventions. The technician joined in robbing himself, for bad distribution dissipated some of the benefits of efficient production.

Comments on the "cult of the huge" raised the question of rationalisation, together with statistical consideration of the outputs of large and smaller concerns in an endeavour to determine which was the more efficient and therefore better for the community. Was it too late to remedy the evils of extreme centralisation and densely populated areas? Bearing in mind the effects of intense mechanisation on the workers, was man in danger of becoming a machine?

Efficient Use of Fuel

AT the request of the Mines Department a series of meetings has been arranged jointly by the Institutions of Civil, Electrical, Mechanical, Gas, Mining and Chemical Engineers, the Institutes of Fuel and Chemistry, the Iron and Steel Institute and the Society of Chemical Industry. The object is to inaugurate an open discussion on the best ways and means of improving the efficient use of fuel and power in existing industrial plants under present conditions and to invite constructive suggestions. The meetings so far arranged are as follows:—

Tuesday, December 16th, 2.30 p.m., at the College of Technology, Sackville Street, Manchester, when the opener of the discussion will be Dr. F. S. Sinnatt, Director of Fuel Research; Saturday, January 3rd, 2.30 p.m., at the H. H. Wills Laboratory, Royal Fort, Bristol, when Mr. J. G. Bennett, a member of the Fuel Efficiency Committee of the Mines Department, will open the discussion; and Thursday, January 8th, 2.30 p.m., at the Institution of Electrical Engineers, London, W.C.2, when the opener will be Dr. E. S. Grumell, chairman of the Fuel Efficiency Committee.

Preceding the meeting on January 8th there will be a luncheon at the Waldorf Hotel, Aldwych, W.C.2, at which Mr. D. R. Grenfell, C.B.E., M.P., Secretary for Mines, will take the chair and give a short address. Applications for tickets (8s.) should be made to the secretary, Institute of Fuel, 30, Bramham Gardens, S.W.5.

Science and the War Effort

THE Association of Scientific Workers is holding an open conference on "Science and the War Effort" on January 10th and 11th in the Caxton Hall, Westminster, S.W.1. The conference will be opened by Mr. R. A. Watson Watt, the president of the Association, and such matters as university training of scientists; training of personnel; building, housing and A.R.P.; food and agriculture; utilisation of scientific and technical personnel; and the application of scientific knowledge to problems of industrial production and to service problems, will be dealt with.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, December 18th, 5 p.m. London. Paper: "Voice-frequency Signalling and Dialling in Long-distance Telephony," by Messrs. W. G. Radley and E. P. G. Wright.

North Midland Centre.—Saturday, December 13th. Leeds. Paper: "Metal Rectifiers," by Messrs. A. L. Williams, Ph.D., M.Sc., and L. E. Thompson, B.Sc.

North-Eastern Centre.—Monday, December 22nd, 6.15 p.m. Neville Hall, Westgate Road, Newcastle-upon-Tyne. Paper: "Electrical Industrial Installations," by Mr. L. C. Grant. *Students' Section.*—Friday, December 19th, 6.30 p.m. Neville Hall. Address by the Centre chairman, Mr. R. W. Gregory.

West Wales (Swansea) Sub-Centre.—Saturday, December 20th, 3 p.m. Chamber of Commerce, Exchange Buildings, Swansea. Paper: "The History and Development of the Radial-Flow Steam Turbine," by Mr. P. S. Wakefield, M.Sc. (Eng.), of the Brush Electrical Engineering Co., Ltd.

North-Western Students' Section.—Saturday, December 13th, 2.30 p.m. Engineers' Club, Albert Square, Manchester. Paper: "The Uses of Electric Power Underground in Coal Mines, with Special Reference to Flameproof Switchgear," by Mr. S. J. Humphries.

Association of Supervising Electrical Engineers.—Saturday, December 13th, 2.30 p.m. Lighting Service Bureau, Savoy Hill, London, W.C.2. Lecture: "Economics of Installation Planning," by Mr. H. Murray Winstanley, M.I.E.E., M.I.Mech.E.

NEW BOOKS

Radio Valve Handbook. Ionic Diffusion.

Thermionic Valves in Modern Radio Receivers. By Alfred T. Witts, A.M.I.E.E. Second edition. Pp. 218; figs. 135. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 10s. 6d. net.

First published in 1936, this handbook deals with the theory of thermionic valves and their application to modern radio receivers. Since the date of the first edition certain changes in receiving valve design have occurred, and new and improved types of valve have been introduced. The second edition of the book brings the subject-matter up to date in this respect, and includes information on the "aligned grid" form of construction and its application to "low noise" R.F. hexodes, and output tetrodes. The principle of negative feedback, and the use of a phase-splitter valve in resistance-coupled push-pull amplifier circuits are two other additions to the text, while the chapter on frequency changer valves has been thoroughly revised.

The principal addition, however, is a chapter on mains rectifier valves and equipment, which for some reason was omitted from the first edition. Half- and full-wave rectification, smoothing, and the arrangements of AC/DC supply circuits are covered. In all there are now ten chapters devoted to the valves used in the various sections of a receiver. Both theoretical and practical information is given, with, in many instances, a certain amount of receiver design data.

Although the second edition is less bulky than the first, due to the use of thinner paper, it actually contains 26 extra pages. In any future edition the author might consider including some information on cathode-ray tuning indicators, and possibly on the "all-dry" battery valve, and its use in a combined battery/mains receiver.—W.E.M.

The Behaviour of Slow Electrons in Gases. By R. H. Healey, D.Sc., F.Inst.P., and J. W. Reed. Pp. 179; figs. 39. *Wireless World*, Dorset House, Stamford Street, London, S.E.1. Price 20s.

The study of ionic diffusion started at the beginning of the present century with the classical researches of Townsend at Oxford. During the past twenty years much of the new work has been carried out by Prof. Bailey and his collaborators in Sydney. It is therefore fitting that this book, which deals primarily with diffusion methods, should emanate from Sydney.

The first two chapters introduce the general theory of diffusion for free electrons and negative ions and describe the experimental technique which has been evolved for determining the various coefficients in terms of which the theory is derived. With the next chapter, which contains a detailed discussion of the assumptions underlying the theory, a very clear exposition of diffusion methods is concluded. Chapter four gives a very useful summary of experimental results in the form of curves and tables including the energy and velocity of agitation, the drift velocity, the mean free path, energy losses in collision and the probability of attachment for electrons in a large number of gases. This section will prove a valuable reference source.

While the book is chiefly of interest to physicists, the last chapter which deals with the effect of electric waves on ionised gases, will be of interest to radio engineers and others who are concerned with the propagation of radio waves. The effect of thunderstorms on the ionosphere and the interaction of radio waves in the ionosphere (the Luxemburg effect) are discussed in detail. Engineers will be impressed by the good agreement between theory and observations.

The authors are to be congratulated on producing a lucid and interesting survey of a difficult subject, much of which was previously only available in original papers to which there are frequent references. The success of the book is largely attributable to the judicious intermingling of theory and practical results which is maintained throughout. The printing is of a high standard and a good index is supplied. For a future edition it should be noted that there are discrepancies between figures 6, 7 and 8 and their textual descriptions.—M.R.G.

Analysis of Aluminium and its Alloys. Enlarged edition. Pp. 186; figs. 16. British Aluminium Co., Ltd., Oakley Manor, Belle Vue, Shrewsbury, Shropshire.

This fresh compilation supersedes an earlier volume and considerably amplifies data previously published on this subject. The steadily growing variety of alloys, together with their superior quality and greater uniformity, have stimulated the evolution of better means of analysis, and this book describes the methods that have proved to be most suitable in service in the company's own laboratories. Some of them are original, though the majority are carefully selected modifications and refinements of older procedures that can be recommended for general use by consultants, works chemists, or metallurgists.

The principle and reagents required and method to be followed in each case are clearly set out to ensure satisfactory analysis by operators not normally associated with the aluminium industry. In recognition of the great advantages in respect of speed without, in many cases, any material loss of accuracy possessed by more recently developed physico-chemical processes, an additional section has been devoted to descriptions of some photometric, spectro-chemical and polarographic means of analysis that have been tested, although not all of them are as yet in routine employment in the company's laboratories.—W.O.F.

Occupational Skin Diseases

A PAMPHLET entitled "Some Notes on Occupational Skin Diseases" has been sent to us by the author, Mr. Alexander Duckham, of Alexander Duckham & Co., Ltd., Bickley, Kent. The author's object is to express in simple, non-technical language certain facts about skin troubles in industry, and the book deals with such aspects as the causes of occupational and non-occupational troubles, prevention and cure, and aspects of the Workmen's Compensation Act.

COMMERCE and INDUSTRY

Electricians' War Bonus. New Limitation Order.

Contractors' War Addition

THE agreement for the payment of a weekly war addition to the wages of operatives in the electrical contracting industry provides that the full weekly amount shall be paid for a minimum of three days' work. Apparently cases have occurred in which men have worked three days for one employer, being paid the war addition, and have then worked the rest of the week for another employer, drawing a second full weekly payment. Again, where holidays are granted without pay it is customary for them to begin on Monday morning and end on the following Saturday. As this frequently covers three days of two working weeks, claims have been made for the weekly war addition in respect of each.

To circumvent this the National Joint Industrial Council for the industry has ruled that no employee shall be entitled to more than the current amount of the weekly addition from any source or sources in any one week. The Council has also laid it down that where a system of holidays with pay is in operation, pay shall include wages and the cost-of-living war addition.

A Tribute to the Technical Press

Some very complimentary remarks about the technical Press were made by Mr. John Pascoe, B.A., deputy chairman of British Timken, Ltd., at a luncheon marking the twenty-first anniversary of the incorporation of the company. He attributed a great deal of his company's success to the British technical Press, not only through advertising. He said that almost every one of their executives read some specialised journal covering his own field. "We encourage them to do this and, in fact, should not think much of a key man who did not go to the obvious source of information about the latest development in his particular sphere—be it chemistry, fuel, electrical plant, the motor industry, heat treatment or any other field. . . . The technical Press is doing very real and vital services to industry. Its work is an essential part of the drive for higher production. It is an essential industry in itself."

Exports to the Far East

Under the Export of Goods (Control) (No. 42) Order, 1941, (S.R. & O. 1941 No. 1932, price 1d.) which came into force on December 3rd, export licences are now required for all goods exported to British North Borneo, British Solomon Islands Protectorate, Cook Islands, Fiji, French Settlements in Oceania, Gilbert and Ellice Islands Colony, Hong Kong, Mandated Territory of New Guinea, Naura, Netherlands East Indies, New Caledonia, New Hebrides (French and British), Norfolk Island, Papua, Philippine Islands, Portuguese Timor, Sarawak, Thailand, Tonga, and Western Samoa.

Purchase Tax on Lighting Fittings

Last year the Electric Light Fittings Association arranged with the Customs and Excise authorities that the wholesale price of fittings made by Association members, for the purpose of computing Purchase Tax, should be taken as the current list price less 34 per cent. This made the tax equivalent to 22 per cent. of the list price. The arrangement was based on the 33⅓ per cent. discount normally allowed (plus 2½ per cent. for cash). It was found, however, that some manufacturers allowed a basic discount of only 25 per cent. to the trade (plus 2½ per cent. for cash). Accordingly it has been decided that as from January 1st the tax in these cases will be taken as equivalent to 25 per cent. of the current list prices.

Where the trade or cash discounts are below the specified figures, or any additional charge is made to the retailer, tax must be paid by reference to a value not less than the full cost of the goods to the retailer.

Limitation of Supplies

The Limitation of Supplies (Miscellaneous) (No. 13) Order, 1941, which came into operation on December 1st, replaces the No. 11 Order of 1941 and fixes the quotas for controlled goods for the six months ending May 31st next.

Most of the principal changes have already been announced, one of them being the provision that an unregistered person who was a manufacturer of controlled goods of any class on December 1st may not supply in any month more than £100 worth of such goods in the manufacture of which he has carried out a process. An unregistered person who was not a manufacturer of controlled goods on December 1st may not in future supply any controlled goods of the class in the manufacture of which he has carried out a process.

The quota for Class 17 in which most of the controlled electrical appliances are included remains at 25 per cent. The same quota will also apply to the lighting fittings included in Class 9 and to radio-gramophones (Class 13).

Electrically-heated pads and blankets have been transferred from Class 6 to Class 17.

Control of Tin

The Minister of Supply has made the Control of Tin (No. 3) Order which provides that as from December 9th all stocks of tin and subsequent arrivals and production must be notified immediately to the Joint Controllers of Non-ferrous Metals, Grand Hotel, Rugby. Henceforward no tin can be acquired or disposed of without a licence from the Ministry of Supply.

Engineers' Wage Claim

On Monday last the National Arbitration Tribunal heard the claim of the Amalgamated Engineering Union and the National Union of Foundry Workers for an advance of 4d. an hour, or 15s. a week, in the basic rate of about 600,000 of their members. Mr. J. Tanner, president of the A.E.U., said that in many districts the wages of fitters and turners were below £4 a week and they were compelled to work excessive overtime to secure a proper living. The employers were depending on the Government's White Paper on wages to secure stabilisation, but that document was repudiated by the trade unions.

Sir Alexander Ramsay, Engineering Employers'

Federation, said that they were not relying entirely on the White Paper, but it had to be taken into account. He denied that the employers were making excessive profits and maintained that the average wage over the whole of the engineering, shipbuilding and metal industries group was £5 11s. and in motor-vehicle and aircraft manufacture £6 7s. 5d.

The Tribunal will announce its decision in due course.

Australian Import Restrictions

The Commonwealth Government has imposed restrictions upon the importation of a wide range of goods from the United Kingdom and the sterling area, with the exception of New Zealand and certain Pacific islands. Imports of refrigerators and vacuum cleaners are totally prohibited and radio valve imports are to be reduced to 25 per cent. of the 1938-39 level and may be licensed for replacements only. The reasons given for the new measure are that it is necessary to check non-essential expenditure and to build up sterling balances overseas.

Rubber Producing Companies

Of the 550 companies covered by the 1941 edition of "Rubber Producing Companies," about 400 are shown in the new form referred to in 1939. It is anticipated that this re-compilation will be completed in the next edition. The particulars of the various companies include analyses of results of the past few years, forward sales, capitalisation per planted acre, investments and reserves, and estate areas. The manual is obtainable from the *Financial Times*, 72, Coleman Street, London, E.C.2, and the Mincing Lane Tea and Rubber Share Brokers' Association, Ltd., Plantation House, Mincing Lane, London, E.C.3, at 10s. 6d.

Changes of Name

J. V. Rushton (Lancs & Yorks), Ltd., Anodic Works, 5, Whitcher Place, Rochester Road, N.W.1, have changed their name to Taunton Metal Processes, Ltd.

The Devonia Finance Corporation, Ltd., 29/40, North Street, Exeter, is now known as the Devonia Finance & Engineering Co., Ltd.

Wartime Recipes

The December number of "Cheerful Rationing," issued by the Electrical Association for Women, 20, Regent Street, London, S.W.1 (price 1d.) is full of bright ideas for making the most of the scanty materials which will be at the disposal of most housewives this Christmas. Christmas pudding without eggs, for instance, will probably be much appreciated.

Peruvian Electrical Imports

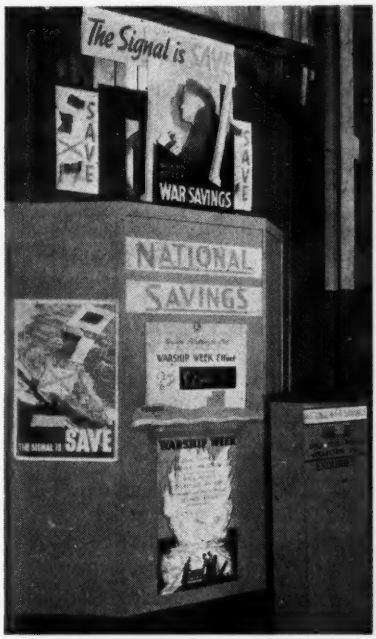
A considerable reduction of electrical apparatus imports into Peru was recorded for the second quarter of the year. The total value is given as 2,840,000 soles as compared with 4,241,000 soles in the June quarter of last year.

The Croydon Showrooms

Referring to the article on the new electricity showrooms and offices of the Croydon Corporation, which appeared in our issue of November 28th, Albion T. Snell & Partners, consulting engineers, inform us that the position with regard to the preparation of specifications, etc., was not correctly stated, and that the whole of the electric lighting and power work, heating (electric thermal storage plant), ventilating, hot-water services, etc., were carried out to their specification and under their supervision, as the consulting engineers appointed for these schemes.

A Works National Savings Scheme

At one of the works of the English Electric Co., Ltd., the savings office was recently specially "dressed" for a Warship Week. The office is in the centre of the works, enabling employees



The savings office at one of the works of the English Electric Co., Ltd.

to buy savings stamps, certificates, etc., with the minimum of trouble. The particular effort of the staff and works employees during the Warship Week realised £7,941. Each of the company's works and branch offices has its savings group and a full-time organiser has been appointed to ensure that the maximum results are obtained.

Fatality in Bathroom

At an inquest held recently at Brentford on Terence Tubb (17), who was found unconscious in the bathroom at his home, the coroner said he was satisfied that the youth died from electric shock and that there was a faulty lamp in the bathroom, but there was no evidence to show how he came to get the shock. It was stated that Tubb was found with one leg hanging over the bath and his head against the towel horse. The table lamp was overturned on the floor about three feet away. The lamp was tested at the

Electricity Department under both dry, and wet and steamy conditions. The first test proved satisfactory, but after the lamp had been affected by steam "shorting" took place. It was found that a copper wire had melted at the base of the lamp where it was not insulated. A verdict of "Accidental death" was returned.

Electric Furnace Fatality

At an inquest recently on Robert H. T. Wall (26) who received a fatal electric shock while repairing an ammeter inside an electric furnace at the works of Thos. Firth & John Brown, it was stated that the man came in contact with a live pin carrying 440 V inside the furnace. The coroner said he was satisfied that it was an accident for which no one was to blame. There was probably an error of judgment by Wall while the work was in progress. A verdict of "Accidental death" was recorded.

Calendars

Ruston & Hornsby, Ltd., have economised in paper in their calendar this year by printing two months on both sides of three sheets, thus only using three sheets of paper instead of six. Each sheet also shows the preceding and following months, and is surmounted by a picture of some famous buildings in various parts of the world.

A useful calendar for 1942, which has sheets showing the previous, current and succeeding months and also daily slips, has been sent to us by the Thames Wire & Cable Co., Ltd.

Gibraltar Import Restrictions

By an Order made under the Supplies (Emergency Control) Ordinance, 1939, electrical equipment is added to the goods the import of which into Gibraltar is subject to restrictions.

Colliery Electrician Fined

For not complying with a Ministry of Labour order to work as an assistant electrician at Ripley Colliery, James Alfred Lamb was fined £3 3s. and costs at Ripley recently. It was stated that when he was told that he must obey the direction defendant replied that he would sooner go into the Forces than go back to the pit.

Summons Dismissed

The hearing was resumed at Woolwich Police Court last week of a summons against Siemens Bros. & Co., Ltd., following an accident at the company's works on July 10th, when Gerald Randolph Kerley received a severe electric shock. The company at the previous hearing had pleaded not guilty to the alleged contravention of Regulation 2 of the Factory and Workshop Act, and the case was adjourned in order that the magistrate could see the machine in question.

John William Jamieson, a beltman, stated that on the day of the incident Kerley was his mate. A piece of lacing was used to put the belt on the pulley. When the job was completed, Kerley bent over to get the piece of hanging lacing and his head came into contact with the wires. Witness heard a shout and saw smoke and sparks coming from Kerley's head. The live wires were used in connection with a crane and were unguarded.

At this point the magistrate said he had seen the machine and he thought that "there was a very simple absence of complete safeguard." He would be prepared to dismiss the case on payment of a small amount of costs.

Mr. A. Perry, factory inspector, stated that he visited the scene of the accident. He was told that the wires could have been made dead if a certain fuse was taken out. In his opinion the wires in question could have been reasonably protected with little difficulty. It was added that the live wires were nine inches above the pulley.

Dismissing the case under the Probation of Offenders Act, the magistrate said that the case had been properly brought. He allowed five guineas costs, adding that this was not to be looked upon as a penalty.

New Catalogues and Lists

Herbert Morris, Ltd., Loughborough, Leics.—Leaflet pointing out the benefits of the company's inspection service in the form of reduced accidents to personnel and the provision of spare parts for averting the breakdown of all kinds of lifting and hoisting appliances.

Hamman Industries, Ltd., 5, Regent Parade, Brighton Road, Sutton.—Two folders dealing respectively with "Delaron" laminated material and "Hamolac" insulating sleeving.

British Insulated Cables, Ltd., Prescot, Lancs.—Illustrated leaflets (N.S.O.–1 to 5) describing the supporting, terminating and collector equipment for cranes and conveyors.

TRADE MARK APPLICATIONS

THE following applications have been made for British trade marks. Objections may be entered within a month from December 3rd:

LUSTRAPHONE. No. 616,489, Class 9. Microphones, loudspeakers, sound amplifiers, cinematograph instruments and apparatus, sound recording and sound reproducing instruments and apparatus; and component parts.—Frederick Fyleman, trading as Lustraphone Co., 120, Station Road, Harrow.

QUAFINE. No. 616,597, Class 9. Electrodes for electric arc welding.—Quasi-Arc Co., Ltd., Grosvenor House, Park Lane, London, W.1.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

Abair Engineering, Ltd., late of 1, Devonshire Street, London, E.C.2.—Present address wanted.

LECTROLITIC contact breaker.

KWIKSHAVE electric razor.

ELRICO handlamp.

ELECTRICITY SUPPLY

Repairing Damaged Installations. Lower Prices at Nottingham.

Barrow-in-Furness.—SUBSTATION EQUIPMENT.—The Electricity Committee has obtained sanction to a loan for substation equipment.

Birkenhead.—REPAIR OF ASSISTED WIRING INSTALLATIONS.—At a recent meeting of the Electricity Committee the town clerk, borough treasurer and borough electrical engineer submitted reports upon questions relating to the repair of assisted wiring installations damaged by enemy action, and the Committee decided that in cases where there are still outstanding payments to be made under agreements the repair of the installations should be carried out at the expense of the Council, a claim in respect of such repairs being subsequently submitted to the War Damage Commission.

PURCHASE OF COOKERS.—The borough electrical engineer reported that approximately 250 cookers were required for housing estates and that he proposed to tender for the purchase of second-hand cookers held for disposal by the Hull Corporation.

LOANS.—The Electricity Committee has obtained sanction to borrow £4,500 for consumers' apparatus.

Blackburn.—SWITCHGEAR.—Additional switchgear is to be purchased from A. Reyrolle & Co., in connection with contracts.

SUPPLY TO COLLIERY.—The Electricity Department is to give a supply of electricity to Rishton Colliery for the pumping plant.

Bolton.—MODIFIED LIGHTING.—The Lighting Committee has approved a scheme for modified electric lighting in Rishton Lane and Higher Swan Lane.

Conisborough.—MODIFIED LIGHTING.—The U.D.C. proposes to carry out a modified street lighting scheme at a cost of from £800 to £1,000.

Eccles.—B.O.T. AND PRICE INCREASE POSITION.—A month ago the Electricity Committee was informed that the Board of Trade was unable to regard the proposed temporary war increase in electricity charges as justified by the present circumstances of the Council's undertaking, and it was decided to communicate again with the Electricity Commissioners on the subject. A letter has since been received from the Board of Trade stating that no order has hitherto been made under the Defence Regulations either by the Minister of War Transport or by the Board of Trade which would preclude the Corporation from carrying the proposed increase into effect or from adjusting its tariffs within the limits of its authorised maximum prices. The Minister of War Transport, prior to the transfer of his electricity functions to the Board of Trade, had intimated in Parliament that if it should be shown to his satisfaction in any individual case that prices had been raised to an undue extent even within the limits of the authorised maximum amount, he would not hesitate to have recourse to his powers under the Defence Regulations in order that an unjustifiable burden was not placed on consumers. The Committee decided that for the time being no action should be taken in regard to bringing the proposed increase into operation.

FRINGE ORDER.—The Electricity Committee has obtained a Fringe Order for the supply of electricity to Barton Moss.

Failsworth.—SHELTER LIGHTING.—The Urban District Council proposes to have electric light installed in approximately 100 shelters.

Guildford.—ADDITIONAL SUPPLY.—The Electricity Committee is to extend the mains and provide additional substation plant for an increased supply to the Guildford Gas & Light Corporation.

Huddersfield.—LOANS FOR METERS.—Sanction has been granted by the Electricity Commissioners for the borrowing by the Corporation of £15,000 for expenditure on meters during the year ending December, 1941. Application has also been made for £5,000 for the year 1942.

FEEDER EXTENSION.—The borough electrical engineer's recommendation that an additional length of main feeder cable should be laid has been approved.

STREET LIGHTING.—The question of increasing the number of "starlights" in the streets has been left to the Highways, Gas and Electricity Committees to deal with.

Inverness.—POSSIBILITY OF RESTRICTION.—Mr. G. C. Maclean, electrical engineer and manager, Inverness, in a statement to the Town Council, foreshadows that unless greater care is taken in regard to the use of electricity in the burgh, the Council may be reluctantly obliged to impose restrictions on the supply.

Kidderminster.—LIGHTING PLANS.—The Town Council is to install modified street lighting with 80 central lamps, and another 40 lamps on selected sites.

Liverpool.—PREPAYMENT METERS.—The Electric Power and Lighting Committee has approved a report by the city electrical engineer recommending that in view of the shortage of prepayment meters, spare parts, repair personnel, etc., the existing arrangements for the supply to tenants of Corporation houses should be varied. Where prepayment meters become faulty and are removed, ordinary meters will be installed and tenants will be required to pay weekly an amount estimated to cover the cost of electricity consumed. Any necessary adjustments will be made after the meters have been read.

London.—WANDSWORTH.—The Borough Council has approved proposals submitted by the County of London Electric Supply Co. for laying underground electric cables.

Northern Ireland.—RATE RELIEF DENIAL.—In the Ulster Parliament recently Sir Basil Brooke, Minister of Commerce, denied the statement that the Government had offered to pay £50,000 a year from the Exchequer in relief of the Belfast rates as an inducement to get the Belfast Corporation to agree to hand over the city electricity undertaking. Sir Basil added that he hoped to make a statement at an early date on the steps contemplated.

Nottingham.—CHEAPER ELECTRICITY.—Last week the City Council approved the reduction

in charges recommended by the Electricity Committee (ELECTRICAL REVIEW, November 28th). The new scale is a reversion to the prices charged before July, 1940, and is as follows:—Lighting flat rate, 4d. per kWh; maximum demand system, 6d. and 2d.; business tariff, £10 per kW of maximum demand, plus ½d. per kWh; domestic tariff, 15 per cent. of the rateable value, plus ½d. per kWh. In the case of bulk supplies it was recommended that reductions from the original contract prices given in 1937, and cancelled in June, 1940, should be reinstated. Councillor F. Mitchell, chairman of the Electricity Committee, moving the adoption of the report, said that the cancellation of the increases was estimated to cost £39,500. The Committee, in making the recommendation, stated that it had had before it the financial return of the undertaking for the six months ended September, 1941, and had considered the question of reducing the charges in consequence of the results shown.

Nuneaton.—PRICE INCREASE DISAPPROVED.—With regard to the proposed increase in charges for electricity the Town Council has been informed that the Electricity Commissioners are not prepared to grant their approval in view of the Government's policy of stabilisation.

Paisley.—PRICE CONCESSION.—The Electricity Committee recommends a reduction in charges for the last quarter of the financial year, which begins in February.

Stoke-on-Trent. — BULK SUPPLY CHARGE REDUCED.—A letter from Stone U.D.C. saying that it was concerned at the considerable increase in the charge for bulk supply was recently considered by the Corporation Electricity Committee. It was agreed to recommend that the figure of 0.015d. per kWh per shilling rise or fall in the price of coal should be lowered to 0.013d., and that the usual discount of 5 per cent. for payment within 28 days should be applied to the account of the U.D.C., as from April 1st this year.

Overseas

India.—BIHAR ELECTRICITY PROJECT.—A detailed scheme in connection with the electricity project for Bihar Province is now ready and is being examined by a British firm of electrical engineers. It is estimated to cost over 30 million rupees, and is designed to provide a supply for both industrial and irrigation purposes. It is proposed to use locally-mined coal to generate power and later to link the project with the hydro-electric plant on the rivers flowing from the Himalayas. The scheme is expected to yield a profit after five years.

TRANSPORT

Blackpool.—AGREEMENT WITH FLEETWOOD.—The Fleetwood Corporation has agreed to withdraw its Parliamentary Bill and Blackpool Corporation is accordingly not taking any steps to have set aside the Order made by the Ministry of War Transport extending for three years Fleetwood's right to acquire the tramway between the two towns, which now falls due.

Glasgow.—REPAYMENT OF DEBT.—To mark the repayment of the debt on the Corporation Transport Department a luncheon was recently held at the City Chambers, and during the proceedings the convener handed to the Lord Provost a cheque for £4,465,000. It was pointed out that when the city took over from a private company in 1894 the total stock of cars was 300. To-day there were 1,834 cars, buses, and underground vehicles. As against 100,000 passengers per day, the system now transported millions daily.

South Shields.—TROLLEY-BUS ROUTE EXTENSION.—The Minister of War Transport has made the South Shields Corporation (Trolley Vehicles) Order, 1941, dated November 13th, authorising the operation of a new trolley-bus route slightly more than a mile in length.

New T.V.A. Station

IN a paper presented at the October meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Messrs. G. R. Rich and R. T. Mathews described the new Watts Bar station of the Tennessee Valley Authority. The first section of 120,000 kW, authorised by Congress on July 31st, 1940, will be completed in February, 1942. The second section of 60,000 kW, authorised in April last, will take a similar time to construct.

The station will provide 180,000 of the 380,000 kW of steam capacity (200,000 kW having already been acquired) included in the T.V.A. scheme, which also provides for 1,408,000 kW of water power. When completed, the installation will consist of three 60,000-kW turbo-alternators (compared with the 57,600 kW of the largest hydro-electric unit) and three 600,000-lb.-per-hr. (700,000 maximum) boilers with cross connections, for emergency use only, between steam and water systems. Cooling water flows through the condensers by gravity from penstocks above the dam. Bleeding is at four points on the turbine. At rated capacity the guaranteed boiler efficiency is 88 per cent. with an air-heater gas-exit temperature of 328 deg. F. The pulverised-fuel burners receive secondary air at 550 deg. F. Furnace heat release is 27,000 BThU per cu. ft. per hr. at full rated output.

As the plant is expected to be in operation for only 4,000 hr. per annum and the cost of coal is low, the steam conditions adopted, *viz.*, 850 lb. per sq. in. and 900 deg. F., were calculated to be the highest that would prove economical. It is estimated that a net heat rate of 11,800 BThU per kWh will be achieved at 66,600 kVA generator output.

Wind-Power Generation

ON October 19th the first wind-driven alternator, it is stated in the *Electrical World*, to be connected to a power-transmission network was synchronised with the 44-kV system of the Central Vermont Public Service Corporation.

The 2.3-kV alternator is rated at 1,000 kW at 600 RPM throughout a range of wind velocities between 18 and 60 MPH. The two propeller blades have a wing spread of 175 ft. and the equipment is mounted on a 110-ft. tower at a height of 2,000 ft. above sea level on the summit of a hill known as Grandpa's Knob.

On this preliminary run a maximum output was obtained of 800 kW with a wind velocity of 26 MPH. The installation cost about $500,000. This figure provides for a laboratory for investigating the commercial possibilities of wind power and so bears little relation to the cost of any subsequent generating units that may be erected.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Crompton Parkinson, Ltd.—The report for the year ended September 30th, which has now been issued, confirms the preliminary statement published in our last issue. The net profit for the period is £391,404 (as compared with £400,514 for 1939–40) to which is added £187,360 brought in, making £578,764. As already announced the central benevolent fund receives £5,000 and the final dividend on the ordinary and "A" ordinary stock is 7½ per cent., making 15 per cent. for the year, plus a cash bonus of 5 per cent. These distributions are the same as for the previous year, and do not include the final dividend and cash bonus which will be payable in respect of the "A" ordinary stock which has been or will be issued credited as fully paid in part satisfaction of the purchase consideration for the acquisition of the issued share capital of the Young Accumulator Co., Ltd., and which the directors also recommend should be declared. It is estimated that the final dividend and cash bonus will amount to about £4,000 gross on the basis that all the issued shares of the Young Accumulator Co. have been or will be acquired.

In his speech, which has been issued with the report and accounts, Mr. F. Parkinson (chairman) says that the company has been fully occupied during the year. Notwithstanding a considerable increase in output achieved during the year the net profit shows a decline as compared with a year ago. The difference is more than accounted for by increased provision for taxation. Since the end of the last financial year the company has acquired over 90 per cent. of the share capital of the Young Accumulator Co., Ltd., and over 99 per cent. of that portion of the share capital of Associated Electric Vehicle Manufacturers, Ltd., not already held by the Young Accumulator Co., Ltd. The board hopes that the small balance of the shares outstanding in each case will shortly be acquired. On the assumption that 100 per cent. acceptances will be obtained in each case the acquisitions will involve, in addition to a cash purchase price of about £104,000, the issue of about £32,000 "A" ordinary stock of the Crompton Parkinson, which issue will rank for the final dividend and bonus for the past year.

The British Electric Transformer Co., Ltd., reports a net profit for the year ended September 30th of £18,387, as compared with £52,532 for the preceding year, to which is added £5,106 brought in, making £23,494 available. As already reported the ordinary dividend is 4½d. per share, less tax (against 2s. per share, free of tax), and the balance carried forward is £6,463.

Ensign Lamps, Ltd., report a trading profit for the year to June 30th of £45,350, as compared with £35,596 in the preceding year. After providing for directors' fees and taxation, it is proposed to pay a final dividend of 15 per cent., maintaining the distribution for the year at 25 per cent. The balance carried forward is £3,003 (against £7,086 brought in).

Electric & Musical Industries, Ltd., reports a net profit for the year to September 30th of £126,581, an increase of £88,533 as compared with the previous year. The dividend for the year on the ordinary capital is 6 per cent., and £194,830 is carried forward (against £169,652 brought in). The last distribution was 5 per cent. in respect of 1937–38. An extraordinary meeting will be held after the annual meeting for the purpose of converting the issued shares into stock.

Sydney S. Bird & Sons, Ltd., report a profit of £10,091 (against £8,021) for the year to September 30th, after providing £1,764 (£1,684) for depreciation, £1,000 (nil) for deferred repairs, £15,000 (£8,358) for taxation and £350 (same) for fees. The dividend is 30 per cent. (against 25 per cent.) and £6,025 is carried forward, compared with £3,434 brought in.

Tube Investments, Ltd., reports a net income of £610,422 for 1940-41, as compared with £820,930 in the preceding year. As already announced, the ordinary dividend has been reduced from 23¾ to 20 per cent.

Lisbon Electric Tramways, Ltd., is maintaining its ordinary dividend at 2½ per cent.

Waygood-Otis, Ltd., has declared an interim ordinary dividend at the rate of 10 per cent. per annum (same).

The London Electrical and General Trust, Ltd. has announced an interim dividend of 2 per cent (unchanged).

The Electric & General Investment Co., Ltd., is repeating its interim dividend of 2½ per cent.

The Sun Electrical Co., Ltd., has declared a dividend of 2½ per cent. in respect of the past year, as for 1939–40.

New Companies

Anglo-American Electrical Appliances, Ltd.—Private company. Registered November 21st. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in electrical, engineering and wireless apparatus, instruments and parts, chemicals and pressed and moulded goods, etc. Directors: A. Hillel, 5, Ferntower Road, E.5; and M. Green, 129, Meadway, Barnet, Herts. Registered office: 7, South Grove House, South Grove, Highgate, N.6.

H. J. Leak & Co., Ltd.—Private company. Registered November 26th. Capital, £2,000. Objects: To carry on the business of manufacturers of, and dealers in, electronic apparatus and component parts thereof, amplifiers, loudspeakers, microphones, wireless and television sets and accessories, etc. The permanent directors are: H. J. Leak, 5, Suffolk House, Queen's Drive, Acton, W.3; J. E. Leak, address not stated; J. F. Hawkins, 5, Suffolk House, Queen's Drive, Acton, W.3. Registered office: Percy Place, Percy Road, Shepherd's Bush, W.12.

Tungsten Distributors, Ltd.—Private company. Registered November 25th. Capital, £10,000. Objects: To carry on the business of manufacturers, distributors, fitters, repairers and merchants of tungsten, molybdenum, tantalum and electrical and wireless apparatus and accessories, general engineering supplies and

tools, etc. The first directors are C. A. Barry and J. Ismay. Solicitors: Ernest G. Scott and Co., 31/2, New Broad Street Avenue, E.C.2.

Plastic Engineers, Ltd.—Private company. Registered November 5th. Capital, £1,000. Objects: To carry on business of mechanical, electrical and general engineers, tool makers, manufacturers of and dealers in lacquers, plastic materials, hardware, wireless and electrical goods, etc. Subscribers: E. Eisner, Sandiway, Farnham, Surrey; and F. Schindler, New House, Hendre Gardens, Llandaff, Cardiff. Solicitors: Alexander Rubens & Co., 73, Basinghall Street, E.C.2.

Wireless Control (Patents), Ltd.—Private company. Registered November 17th. Capital, £1,000. Objects: To develop, manufacture or vend instruments for radio or other remote control, and to carry on the business of engineers, experimenters, etc. Directors: R. M. Trevethan, 2, Kidwell Park Drive, Maidenhead, and three others. Solicitors: Lewin, Gregory & Co., 2, Millbank House, S.W.1.

Gold Star Battery Co., Ltd.—Private company. Registered December 1st. Capital, £100. Objects: To carry on the business of battery manufacturers, manufacturers of and dealers in accumulators and automobile accessories, etc. Subscribers: P. Oestreicher, 68, Woodseer Street, E.1, and O. Hiles, 14–18, High Holborn, W.C.1. Registered office: 14–18, High Holborn, W.C.1.

Companies' Returns

Statements of Capital

Baker & Hyman, Ltd.—Capital, £2,000 in 2,000 shares of £1 each. Return dated June 14th. All shares taken up. £15 paid. £1,985 considered as paid. Mortgages and charges: Nil.

A. Anderson & Son (Electrical Engineers), Ltd.—Capital, £3,000 in 3,000 shares of £1 each. Return dated July 3rd. All shares taken up. £3,000 paid. Mortgages and charges: Nil.

Lewes & District Electric Supply Co., Ltd.—Capital, £70,000 in £1 shares. Return dated July 3rd. 69,000 shares taken up. £57,500 paid. £11,500 considered as paid. Mortgages and charges: Nil.

Potteries Electrical Warehouse, Ltd.—Capital, £2,000 in 2,000 shares of £1 each. Return dated July 7th. 1,225 shares taken up. £1,245 paid, including £20 paid on 200 shares forfeited. Mortgages and charges: Nil.

Walters Electrical Manufacturing Co., Ltd.—Capital, £18,000 in 18,000 shares of £1 each. Return dated July 8th. 16,875 shares taken up. £6,875 paid. £10,000 considered as paid. Mortgages and charges: Nil.

Caxton Electric Developments, Ltd.—Capital, £300,000 in £10 shares. Return dated July 8th. 20,000 shares taken up. £70 paid. £199,930 considered as paid. Mortgages and charges: Nil.

West Cambrian Power Co., Ltd.—Capital, £800,000 in 800,000 ordinary shares of £1 each. Return dated August 8th. 615,000 shares taken up. £614,066 5s. paid. £933 15s. considered as paid. Mortgages and charges: Nil.

Frinton-on-Sea & District Electric Light & Power Co., Ltd.—Capital, £100,000 in 100,000 ordinary shares of £1 each. Return dated August 8th. 80,000 shares taken up. £80,000 paid. Mortgages and charges: Nil.

Raydex Electric Heaters, Ltd.—Capital, £2,000 in £1 shares. Return dated September 2nd, 1941. 2 shares taken up. £2 paid. Mortgages and charges: Nil.

John Richards & Co. (Electrical Engineers), Ltd.—Capital, £6,000 in £1 shares. Return dated December 31st, 1940 (filed September 2nd, 1941). 4,802 shares taken up. £2 paid. £4,800 considered as paid. Mortgages and charges: Nil.

Wood Auto-Electrical Co., Ltd.—Capital, £4,000 in £1 shares. Return dated September 3rd, 1941. 3,801 shares taken up. £1,301 paid. £2,500 considered as paid. Mortgages and charges: Nil.

Bradford Electrical Services, Ltd.—Capital, £5,000 in 5,000 shares of £1 each. Return dated July 31st. All shares taken up. £5,000 paid. Mortgages and charges: Nil.

West London & Provincial Electric & General Trust.—Capital, £390,000 in £198,000 ordinary stock and £192,000 preference stock. Return dated June 12th. All stock taken up. £264,000 paid. £126,000 considered as paid. Mortgages and charges: £200,000.

Parolle Electrical Plant Co., Ltd.—Capital, £100,000 in 100,000 shares of £1 each. Return dated June 25th. 50,000 shares taken up. £50,000 paid. Mortgages and charges: Nil.

S. H. Heywood & Co., Ltd.—Capital, £34,000 in 18,000 cumulative preference shares of £1 each and 32,000 ordinary shares of 10s. Return dated June 26th. All shares taken up. £20,000 10s. paid. £13,999 10s. considered as paid. Mortgages and charges: Nil.

Receiver Released

Gambrell Radio Communications, Ltd. (in liquidation).—J. F. Mallabar, of 1, Regent Street, S.W.1, ceased to act as receiver on October 5th, 1941.

Bankruptcy

L. F. Kent, radio and electrical engineer, 32, High Street, Broadstairs.—Last day for receiving proofs for dividend, January 5th. Trustee, Mr. H. C. Treby, 7, Warwick Court, Gray's Inn, London, W.C.1.

Liquidations

Weston Wireless, Ltd.—Meeting January 2nd, at 39–41, New Broad Street, London, E.C.2, to receive an account of the winding-up by the liquidator, Mr. D. Mahony.

G. A. Brittain (Radio), Ltd.—Meeting December 31st, at "Tanrego," Trearddur Bay, Anglesey, to receive an account of the winding-up by the liquidator, Mr. A. H. Walkey.

Unilectric, Ltd.—Meeting January 5th, at 52, Grosvenor Gardens, London, S.W.1, to receive an account of the winding-up by the liquidator, Mr. J. D. Shepard.

S. H. Nicholds & Co., Ltd.—Meeting December 31st, at 21, Hermitage Road, Edgbaston, Birmingham, to receive an account of the winding-up by the liquidator, Mr. H. C. Kelley.

STOCKS AND SHARES

TUESDAY EVENING.

GENERAL conditions in the Stock Exchange markets were not fundamentally altered by Japan's aggression in the Pacific area although stocks immediately affected were marked down—Tokyo Electric sixes to 20—and there was some drying-up of business. Money continues to flow steadily into gilt-edged securities and into the best-class of the Home industrial ordinary shares. Dividend anticipations have come to help the Home Railway market, and to more than offset the influence of the Labour Party's proposal that railways and other undertakings should be nationalised. Scarcity of stock continues to be an outstanding feature, and any demand, however slight, serves to draw attention to the bareness of the jobbers' shelves in regard to the amount of supply available.

Company reports are, on the whole, satisfactory, and it is now becoming possible to estimate with some degree of accuracy the effect upon industry of E.P.T. and other war burdens. The recent excitement which prevailed in connection with South American issues, and which served to put up the prices of Argentine, Brazilian and other Latin-American issues, has subsided.

Gilt-Edged Securities

During the past few days a steady stream of capital has been directed towards the prior-charge stocks of the Home Railway companies, and to other securities, of which those issued by the Central Electricity and London Passenger Transport Boards offer a certain amount of selection. This capital is obviously part of the money now released by the Treasury payment for the South African stocks just requisitioned. The amount of gilt-edged stock available in the Home Railway market has been for some time past a dwindling quantity, and the present demand is making further inroads into the supplies. Such a stock as London Passenger Transport 5 per cent. "B." for instance, has become the subject of inquiry owing to the yield—£4 7s. 4d. per cent.—that it affords. Central Electricity Board stocks give an average return of 4 per cent. on the money, the highest yield—£4 11s. per cent.—being available from the 1950-70 issue. The reason for the comparatively generous return is, of course, the fact that the stock may be repaid at 100 on March 1st, 1950, and the buyer of to-day has to be prepared to face a possible capital depreciation of 10 points in eight and a half years' time.

Redeemable Stocks

The debenture and guaranteed stocks of the Home Railway companies are mostly irredeemable, and in spite of the reluctance on the part of some present-day investors to put money into any security which has no definite date for its repayment, the demand for safety can over-ride the redemption requirement. With the area of choice so limited as it is at present, the investor who feels that he has money with which to buy stocks other than War Loans, is more or less obliged to take undated stocks. The West Midlands Joint Electricity 5 per cent. stock, which has risen to 109½, is dated 1948-68, and, unless conditions alter greatly within the next few years, it is no more than prudent to assume that on April 1st, 1948, stockholders may be repaid at 100. The same argument applies, also, to London & Home Counties 4½ per cent. stock of 1955-75, although in this case the loan has at least thirteen years to run before it can be redeemed. The price shows a point rise at 110.

Changes in Prices

The hand of the would-be buyer is seen in the rises which have occurred in such shares as Murex, which are ¼ up at 93s. 9d. ; in Westinghouse Brake, 1s. 9d. higher at 51s. 3d. ; and, as a natural corollary, a rise of 2s. 6d. in Consolidated Signals to £4. Electric Constructions are a good market with a rise of a florin to 34s. 6d., there being some talk of the dividend being increased. Automatic Telephones strengthened to 2½ and British Aluminiums are better at 45s. 9d. An improvement to 23s. in Aron Electrics had no effect in bringing in shares to satisfy the present demand. Crompton Parkinsons hold their rise of 2s. 6d., the full accounts being considered good.

Electricity supply prices are notable mostly for improvements in the preference issues. In the Overseas group, Palestine Electric hardened to 20s. 9d. ; Victoria Falls Power are again ⅛ up at 81s. 3d. Cable & Wireless stocks hold their prices. A rise of ⅛ brings Oriental Telephones to 77s. 6d. Thorn Electrical Industries 5s. ordinary shares have been changing hands at around 12s. 6d. The dividend for the year ended last March was 20 per cent. A. C. Cossor shares have hardened to 8s. 10½d. Electric and Musical Industries remain at 15s.

Joseph Lucas

The chairman at the recent meeting of Joseph Lucas, Ltd., in his review of the company's past year, touched upon several points which possess a wider application than that which referred to his own company. There are many undertakings at the present time whose liquid resources, as in this case, have undergone a complete change owing to the very considerable rise in production, resulting in much larger stocks, debtors and creditors. Sometimes this leads to the need for a bank overdraft. After the war, the situation will be reversed, for, as debtors and creditors are liquidated and stocks become realised, the cash balance will be restored. Furthermore, the

(*Concluded on page* 685)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend 1939-40	Dividend 1940-41	Middle Price Dec. 9	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	15	12½	53/9	..	4 12 9
British Power and Light	7	6	26/6	..	4 10 7
City of London	7½	7	25/9	..	5 8 9
Clyde Valley	8	8	37/6	..	4 5 4
County of London	10½	8	35/-	..	4 11 5
Edmundson's:					
7% Pref.	7	7	32/6	..	4 6 2
Ord.	6	6	28/- xd	+3d.	4 5 9
Elec. Dis. Yorkshire	9	9	42/-	..	4 5 9
Elec. Fin. and Securities	12½	12½	43/9	..	5 14 2
Elec. Supply Corporation	11½	10	43/9	..	4 11 4
Isle of Thanet	2	Nil	9/-	..	—
Lancs Light and Power	7½	7½	33/9	..	4 9 0
Llanelly Elec.	5½	5½	22/-	..	5 0 0
Lond. Assoc. Electric	5½	4½	19/6	..	4 12 4
London Electric	7	7	24/6	..	5 14 3
London Power Deb. Red.	5	5	104	..	4 16 2
Metropolitan	10	8	36/3	..	4 8 5
Midland Counties	8	8	37/6	..	4 5 4
Mid. Elec. Power	9	9	39/6	..	4 11 2
Newcastle Elec.	7	7	27/6	..	5 1 10
North Eastern Elec.:					
Ordinary	7	7	29/6	..	4 15 0
7% Pref.	7	7	32/6	..	4 6 2
Northampton	10	10	41/6	..	4 10 0
Notting Hill 6% Pref. (£10)	6	6	8½	..	—
Northmet Power:					
Ordinary	10	7	35/-	..	4 0 0
6% Pref.	6	6	30/-	+6d.	4 0 0
Richmond Elec.	6	6	22/6	..	5 6 8
Scottish Power	8	8	38/9	..	4 2 9
Southern Areas	5	5	18/3	..	5 9 7
South London	7	7	23/6	..	5 19 2
West Devon	5	5	21/3	..	4 14 1
West Glos.	4½	4½	19/6	..	4 12 4
Yorkshire Elec.	8	8	39/6	..	4 1 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	4/-	..	—
Calcutta Elec.	8*	7*	39/-	+1/-	—
Cawnpore Elec.	10	10	30/-	..	6 13 4
East African Power	7	7	27/-xd	+4d.	5 3 8
Jerusalem Elec.	7	5	18/9	..	5 6 8
Kalgoorlie (10/-)	7½	7½	13/-	..	5 15 5
Madras Elec.	6*	4*	22/6	..	3 11 1
Montreal Power	1½	1½	25½	..	5 13 2
Palestine Elec. "A"	Nil	Nil	20/9	+1/6	—
Perak Hydro-elec.	6	7	18/9xd	+9d.	7 9 4
Shawinigan Power	83cts.	90cts.	15	−½	—
Tokyo Elec. 6%	6	6	20	−11½	18 9 2
Victoria Falls Power	15	15	81/3	+1/6	3 14 0
Whitehall Inv. Pref.	7½	7½	15/-	..	10 0 0

Company	Dividend 1939-40	Dividend 1940-41	Middle Price Dec. 9	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1950-70	5	5	110	..	4 11 1
1955-75	5	5	114	..	4 7 9
1951-73	4½	4½	106½xd	..	4 4 6
1963-93	3½	3½	101	..	3 9 4
1974-94	3½	3½	96½	..	3 7 4
London Elec. Trans. Ltd.	2½	2½	97	+½	2 11 6
London & Home Counties 1955-75	4½	4½	110	+1	4 1 10
Lond. Pass. Trans.:					
A	4½	4½	116½xd	..	3 17 3
B	5	5	114½xd	..	4 7 4
C	1½	3	41	..	7 6 4
West Midlands J.E.A. 1948-68	5	5	109½	+1	4 11 4
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	106½	..	5 12 9
Def.	1½	1½	24½	..	6 2 5
Anglo-Portuguese	8	8	16/3	..	9 17 0
Cable & Wireless:					
5½% Pref.	5½	5½	105	..	5 4 10
Ord.	4	4	71	..	5 12 8
Canadian Marconi $1	Nil	4cts.	6/6	..	2 10 0
Globe Tel. & Tel.:					
Ord.	8½*	8½*	31/3	..	—
Pref.	6	6	30/	..	4 0 0
Great Northern Tel.:					
(£10)	20	20	14½	..	—
Inter. Tel. & Tel.	Nil	Nil	3	..	—
Marconi-Marine	7½	7½	28/9	..	5 4 4
Oriental Tel. Ord.	11½*	16	77/6	+1/6	4 2 6
Telephone Props.	6	6	10/-	−1/6	12 0 0
Tele. Rentals (5/-)	10	10	8/9	..	5 14 3
Traction and Transport					
Anglo. Arg. Trams:					
First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc.	Nil	Nil	6½	..	—
Brit. Elec. Traction:					
Def. Ord.	45	45	925	..	4 17 3
Pref. Ord.	8	8	170	..	4 14 2
Bristol Trams	8*	8	43/9	+1/6	3 13 1
Brazil Traction	$1	50c.	11½	−⅛	—
Calcutta Trams	8	5½	22/6	..	4 17 9
Cape Elec. Trams	5	5	20/-	..	5 0 0
Lancs Transport	10	10	42/6	..	4 14 1
Mexican Light:					
1st Bonds	5	5	75	..	6 13 4
Rio 5% Bonds	5	5	92½	..	5 8 3
Southern Rly.:					
5% Pref.	5	5	64½	+1	7 15 0
5% Pref.	5	5	105½	..	4 14 9
T. Tilling	10	10	47/6	..	4 4 2
Tilling & B.A.	8*	7*	52/6	..	2 13 4
West Riding	10	10	39/6	..	*5 1 3

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Dec. 9	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord. ..	Nil	7½	23/–	+6d.	6 10 4
Assoc. Elec. :					
Ord.	10	10	43/9	..	4 16 3
Pref.	8	8	38/9	..	4 2 4
Automatic Tel. & El.	12½	12½	50/–	+⅛	5 0 0
Babcock & Wilcox	11	11	45/–	..	4 17 9
British Aluminium	12½	10	45/9	+9d.	4 7 4
British Insul. Ord.	20	20	90/–	..	4 9 0
British Thermostat (5/–)	18½	18½	13/9	..	6 14 6
British Vac. Cleaner (5/–)	12½	10	12/6	..	4 0 0
Brush Ord. ..	Nil	Nil	4/6	..	—
Callender's ..	15	15	73/9	..	4 1 4
Chloride Elec. Storage	15	15	71/3	..	4 4 3
Consolidated Signal	17	17	80/–	+½	4 5 0
Crabtree (10/–) ..	17½	17½	28/3	..	6 4 0
Crompton Parkinson Ord. (5/–) ..	30	20	22/6	..	4 8 6
E. K. Cole (5/–) ..	10	Nil	9/–	..	—
E.M.I. (10/–) ..	Nil	6	15/–	..	4 0 0
Electric Construction	10½	10	34/6	+2/–	5 16 0
Enfield Cable Ord.	16½	12½	53/9	..	4 13 0
Elec. Switchgear (10/–)	16	10	20/–	..	5 0 0
English Electric ..	10	10	37/6	..	5 6 8
Ensign Lamps (5/–)	25	25	15/–	..	8 6 8
Ericsson Tel. (5/–) ..	25*	22*	40/–	..	2 15 0
Ever Ready (5/–) ..	40	40	30/6	..	6 11 2
Falk Stadelmann ..	7	7½	19/6	..	7 13 10
Ferranti Pref. ..	7	7	26/3	..	5 6 10
G.E.C. :					
Pref.	6½	6½	32/6xd	+6d.	4 0 0
Ord.	20	17½	78/9	..	4 8 10
Greenwood & Batley	15	13	25/9	..	10 2 0
Hall Telephone(10/–)	15	10	15/7½	..	6 8 0
Henley's (5/–) ..	20	20	22/6	..	4 9 1
4¼% Pref. ..	4¼	4¼	21/3	..	4 4 8
Hopkinsons ..	15	15	45/–	..	6 13 4
India-Rubber Pref.	5½	5½	21/3	..	5 3 6
Intl. Combustion ..	32½	30	105/–	..	5 14 3
J. Lucas	15	15	36/3	+½	4 10 8
Johnson & Phillips	15	15	55/–	..	5 9 1
Lancashire Dynamo	20	20	65/–	..	6 3 1
Laurence, Scott(5/–)	15	15	11/–	..	6 16 4
London Elec. Wire	7½	7½	25/–	..	6 0 0
Mather & Platt ..	13½	10	41/3	..	4 14 1
Metropolitan Elec. Cable Pref. ..	5½	5½	21/3	..	5 3 6
Murex	20	20	93/9	+½	4 5 3
Pye Deferred (5/–)	25	25	13/9	..	9 1 10
Revo (10/–) ..	5	20	25/7½	..	7 16 0
Reyrolle	12½	12½	56/3	..	4 9 0
Siemens Ord. ..	7½	7½	25/–	..	6 0 0
Strand Elec. (5/–) ..	2	4	3/6	..	5 14 4
S. Smith (4/–) ..	37½	50	7/6	..	6 13 4
Switchgear & Cowans (5/–) ..	10	15	10/–	..	7 10 0
Tel. Condenser(10/–)	Nil	5	11/3	..	4 9 0
T.C. & M.	10	10	41/3	..	4 17 0
Telephone Mfg.(5/–)	9	9	8/3xd	..	5 9 1
Tube Investments..	23¾	20	87/6	..	4 11 4
Vactric (5/–) ..	4	Nil	3/6	..	—
Vickers (10/–) ..	10	10	18/–	..	5 11 1
Ward & Goldstone (5/–)	20	20	17/6	..	5 14 3
Westinghouse Brake	17½	10	51/3	+1/9	3 18 2
Walsall Conduits(4/–)	55	55	32/6	..	6 15 4
West, Allen (5/–) ..	7½	7½	5/–	..	7 10 0

* Dividends are paid free of Income Tax.

Stocks & Shares (*Concluded from page* 683)

same speech will strike a responsive note in the statement that the profit for the year is entirely governed by taxation. The price of Joseph Lucas ordinary shares is 2s. 6d. better at 66s. 3d., shares having changed hands up to 67s., within the past few days. At the latter price the yield on the basis of the 15 per cent. dividend now being paid comes to £4 9s. 7d. per cent.

Perak Hydro-Electric

The full report of the Perak River Hydro-Electric Co. showed that there was every justification for the bonus to be raised by 1 per cent., making, with the dividend, 7 per cent., for the year, as previously notified. The carry-forward of £47,000 compares with £20,000 a year ago. The company has invested £100,000 in Government securities. The cash position has risen from £58,000 to £234,000. It may be presumed that the excellence of the figures, coupled with the investment demand of to-day for shares in progressive companies, would have lifted the price to, at all events, 20s., had it not been for the situation created by Japan, which has brought the F.M.S. and adjacent areas directly into the war zone.

Nationalisation

The Labour Party's demand for nationalisation of the railways, the mining and munitions industries, as the price of their support of man and woman power extension, received short shrift from the Lord President of the Council, but it is intriguing to visualise what would have happened in bygone days at the mere whisper of such a suggestion. There would have been, it is certain, heavy falls in Home Rails and in a number of industrials. But, the times having so greatly changed, the Home Railway market has entirely disregarded the debate and the disposition of the past few business days has been to put prices decidedly better. Nationalisation, once a bogey to the Home Railway market, has lost its terrors. Sir John Anderson pointed out that the income of the wage-earning community during the war had gone up by as much as 43 per cent. The returns of companies' earnings, he added, showed business profits which, after deduction of tax, were at least 20 per cent. less than they were before the war.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.*2.

1939

15033. "Apparatus for flashlight photography." Murphy Radio, Ltd., and E. A. H. Goldring. May 20th, 1939. (541066.)

21553. "Apparatus for the injection-moulding of thermo-setting plastic masses or compositions." J. Krause Ges. July 8th, 1939. (Addition to 518294.) (541050.)

30888. "Electric protective systems." A. Reyrolle & Co., Ltd., H. Leyburn and A. F. B. Young. November 27th, 1939. (541172.)

1940

1247. "Control devices for railway signalling systems." Westinghouse Brake & Signal Co., Ltd. April 13th, 1939. (541038.)

2556. "Air compressors." J. Browett Lindley (1931), Ltd., and J. Hutton. February 9th, 1940. (541175.)

2585. "Electro-mechanical infinitely-variable speed gear." H. F. Liebrecht. February 10th, 1940. (541105.)

3203. "Process for purifying, separating and concentrating colloidal dispersions by electrical means." P. Stamberger. February 20th, 1940. (541177.)

5729. "Circuit arrangement for controlling two or more discharge tubes each with a separate control circuit." Philips Lamps, Ltd. April 1st, 1939. (541041.)

5875. "Synchronising systems for facsimile recorders or the like." Radio Inventions, Inc. November 6th, 1939. (541042.)

6391. "Tele-communication exchange systems." Standard Telephones & Cables, Ltd., and E. P. G. Wright. April 9th, 1940. (541074.)

6537. "Means for purifying and/or cleansing gases." Brush Electrical Engineering Co., Ltd., B. E. M. Monck and A. C. Morrison. April 11th, 1940. (541093.)

8324. "Method of, and apparatus for, recording the broadcast station to which a radio receiver is tuned." H. L. Rusch. May 12th, 1939. (541079.)

8354. "Fluorescent lighting fittings." A. E. Iliffe, and Benjamin Electric, Ltd. May 9th, 1940. (541144.)

8388. "Furnaces." J. McDonald and G. W. B. Electric Furnaces, Ltd. May 9th, 1940. (541085.)

8389. "Estimation of ammonia." F. W. Haywood, and Wild-Barfield Electric Furnaces, Ltd. May 9th, 1940. (541086.)

8474. "Electric condensers." Standard Telephones & Cables, Ltd., and J. A. Leno. May 10th, 1940. (541096.)

8528. "Fuses for the protection of electric circuits." H. H. Garrett, C. S. Lawson, Lawson Beck, Ltd., and Artic Fuse & Electrical Manufacturing Co., Ltd. May 11th, 1940. (541116.)

8546. "Machines for, and methods of, resistance butt-welding." Babcock & Wilcox, Ltd. June 3rd, 1939. (541102.)

8564. "Induction furnaces." Lancashire Metal Subliming Corporation, Ltd., and W. B. Hamilton. May 13th, 1940. (Cognate application, 10036/40.) (541147.)

8584. "Electric oscillation generators." Marconi's Wireless Telegraph Co., Ltd. May 13th, 1939. (541149.)

8594. "Electricity meters." T. C. Richardson. May 13th, 1940. (541150.)

8641. "Indicators, particularly order-indicators for gun positions." Standard Telephones & Cables, Ltd., B. B. Grace and W. H. M. Hellier. May 14th, 1940. (541182.)

8650. "Co-ordinate measuring machines." Adam Hilger, Ltd., and J. H. Dowell. May 14th, 1940. (Cognate application, 2768/41.) (541183.)

8817. "Optical projection of images." British Thomson-Houston Co., Ltd., and A. Bowen. May 17th, 1940. (541155.)

8920. "Machine to enable electric current to flow through all parts of the body whilst exercising with chest expander, fixed cycle and rowing machine." R. G. Jones and S. J. Jones. May 20th, 1940. (54118.)

9217. "Modulation of magnetron oscillators." Marconi's Wireless Telegraph Co., Ltd. May 24th, 1939. (541120.)

9303. "Electric control apparatus." British Thomson-Houston Co., Ltd., and W. L. Wise. May 27th, 1940. (541121.)

9678. "Electric motors." British Thomson-Houston Co., Ltd. June 3rd, 1939. (541054.)

10072. "Electric lampholders." Ward & Goldstone, Ltd., and S. Goldstone. June 10th, 1940. (541159.)

10174. "Method of, and apparatus for, determining the surface hardness or resistance to scratching of smooth or polished surfaces of materials, or of coated objects or materials." M. J. Cradick, A. R. Dunton, and Metropolitan-Vickers Electrical Co., Ltd. June 11th, 1940. (541122.)

10238. "Signalling and like lamps." Sun Electrical Co., Ltd., and A. G. Moore. June 12th, 1940. (541187.)

10756. "Thermal responsive devices." British Thomson-Houston Co., Ltd. June 23rd, 1939. (541125.)

11620. "Differential pressure flow meters." Electroflo Meters Co., Ltd., and J. P. Bridges. July 12th, 1940. (541059.)

12399. "Electrical systems of remote-control." General Electric Co., Ltd., and N. C. Smart. July 31st, 1940. (541061.)

12753. "Control circuit arrangements for mercury-vapour rectifiers." Marconi's Wireless Telegraph Co., Ltd., and C. C. Whitehead. August 8th, 1940. (541191.)

14048. "Heat-exchange apparatus, more particularly adapted for cooling lubricating oil in bearings." British Thomson-Houston Co., Ltd. (Tokyo Shibaura Denki Kabushiki Kaisha). September 10th, 1940. (541135.)

14609. "Impellers for wind motors." J. R. Albers. September 26th, 1940. (541137.)

14710. "Radio echo distance meters." British Thomson-Houston Co., Ltd. September 29th, 1939. (541194.)

18046. "Control arrangements for gas-blast circuit-breakers." British Thomson-Houston Co., Ltd. December 22nd, 1939. (541165.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia. — SYDNEY COUNTY COUNCIL.—January 29th. Steam and feed water piping for No. 10 turbo-alternator for the Bunnerong power station. Specification 559.

South Africa.—DURBAN.—January 16th, 1942. City Council. Potential and current transformers. Contract E.2038.

JOHANNESBURG.—December 27th. City Council. Low-voltage metal-clad switchboards. Contract 883. Oil-immersed circuit-breakers. Contract 884.

Southport.—January 3rd. Corporation. Maintenance of two electric lifts at the new police headquarters. (See this issue.)

Orders Placed

Barrow-in-Furness. — Electricity Committee. Accepted. Transformer and switchgear (£7,277) Metropolitan-Vickers Electrical Co., Ltd.

Birkenhead.—Electricity Committee. Accepted. 450-kVA transformer.—Bryce, Ltd. Contract extensions for six months.—Paper insulated cables.—Aberdare Cables, Ltd., Scottish Cables, Ltd., Britannic Cable & Construction Co., Ltd. Rubber insulated cables.—Durham Cables, Ltd.; Wm. Geipel, Ltd.; Mersey Cable Works, Ltd.

London.—LEWISHAM.—Emergency Committee. Accepted. Electricity installation at cleansing posts (£159).—South Metropolitan Electric Light & Power Co.

METROPOLITAN WATER BOARD.—Recommended. One electric borehole pump and two centrifugal pumps for Eynsford waterworks (£3,495).—Harland Engineering Co.

Manchester.—Electricity Committee. Accepted. Cable—Aberdare Cables, Ltd.

Salford.—Light, Heat and Power Committee. Accepted. Coal conveyor belt (£158).—F. Reddaway & Co., Ltd. Protection for plant (£515).—Wm. Cornall & Sons, Ltd. Boiler tubes (£571).—Babcock & Wilcox, Ltd.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bolton.—Mill extensions; T. M. Hesketh & Sons, Ltd.

Canteen, Back Sofa Street; Croft Engineering Co., Ltd.

Extensions; William Ryder, Ltd.

Canteen, Back Broom Street; H. Peers & Co., Ltd.

Bournemouth.—Food depot and restaurant; Borough engineer.

Carmarthen.—Adaptation and equipment of Hall, John Street, as British Restaurant (£853); borough surveyor, John Street.

Caterham.—Decontamination centre, Warlingham; U.D.C. surveyor.

Chapel-en-le-Frith.—Hostel for evacuees, and sick bay with 40 beds, at Eaves Hall; T. Dinsdale, surveyor, Council offices, Station Road, Chapel-en-le-Frith.

Chesterfield.—Additional buildings for nurses; T. Pearson, chairman, Board of Management Chesterfield and North Derbyshire Royal Hospital, Chesterfield.

Chichester.—Nursery at Oaklands Park, for West Sussex C.C.; county architect, County Hall, Chichester.

Chipping Norton.—British Restaurant at Charlbury, for R.D.C.; clerks' office, 16a, Market Place, Chipping Norton.

Chislehurst.—Public cleansing centre (£3,250), for Chislehurst and Sidcup U.D.C.; surveyor, Council offices, Sidcup Place, Sidcup, Kent.

Congleton.—Junior Council School, Wesley Avenue; E. M. Parkes, county architect, The Castle, Chester.

Consett (Co. Durham).—Further British Restaurant; P. Leath, surveyor, U.D.C. offices, Blackhill, Co. Durham.

Darlington.—British Restaurant at the Corn Exchange; borough engineer.

Houses, Eastbourne; Ministry of Works and Buildings.

Drighlington.—Additions, Hill Top; T. Holdsworth & Sons, Ltd.

Dundee.—Restoration of workshop building after fire for Corporation Gas Committee; city architect.

Ealing.—Stores, Wadsworth Road and Bilton Road, for Ponds Extract Co., Ltd.; Harriss & Harriss, architects, 43, Bedford Row, W.C.1.

Additions, North Circular Road, for S. E. Opperman, Ltd.; McManus & Co., builders, High Road, Whetstone, N.20.

Eccles.—Additions; Mitchell, Shackleton & Co., Ltd.

Foundry; Sir W. H. Bailey & Co., Ltd.

Central kitchen, Beech Street; borough engineer.

Edinburgh.—Adaptation of ground floor at St. Giles School as kitchen, etc. (£10,950); J. Storrar, town clerk, City Chambers.

Gas cleansing depot for corporation; city architect.

Fenton.—Pit-head baths, Berry Hill Colliery; Miners Welfare Committee.

Fife.—Thirty-four 12-unit shelters and twenty-four 24-unit shelters at Kincardine-on-Forth for county council; G. Sandilands, chief engineer, A.R.P., county offices, Kirkcaldy.

Gateshead.—Erection of four garages (£2,000); J. Clark & Son, builders, New Seaham, Co. Durham.

Central kitchen and canteens at 14 schools (£5,400); F. H. Patterson, borough engineer, Municipal Buildings, Gateshead.

Gloucestershire.—Senior approved school at Bowden Hall; county architect, Shire Hall, Gloucester.

Gomersal.—Warehouse and offices, Oxford Road; F. Senior, Ltd., haulage contractors, 145, Oxford Road.

Hinckley.—Conversion of old factory premises, Wood Street, into British Restaurant, for U.D.C.; A. S. Atkins, clerk, 16, Station Road.

Hindley.—Day Nurseries for U.D.C.; P. Fairclough, surveyor, Council offices, Hindley, near Wigan.

Hull.—Club at police headquarters; A. Rankine, city architect, Guildhall, Hull.

Kettering.—Nursery on site adjoining Linden Avenue; surveyor, Council offices, High Street.

Keynsham.—Adaptation of Women's Institute for use as British Restaurant (£850) for U.D.C.; surveyor, Council offices, Keynsham, Bristol.

Kirkburton.—Community feeding centres at Lepton, Kirkheaton, Kirkburton, and Shelley Bank Bottom, for U.D.C.; F. Hobson, surveyor, Town Hall, Kirkburton, near Huddersfield.

London.—Repairing Guildhall Library (£2,250); City Corporation.

Loughborough.—Communal kitchen (£4,000); C. Gorman, borough engineer, Town Hall.

Macclesfield.—Nursery, Poplar Road; borough surveyor, Town Hall.

Manchester.—Concentrator plant for processing of kitchen waste (£3,500); G. N. Hill, city architect, Town Hall.

Decontamination laundries (£4,772); city architect.

Four shops, Hollyhedge Road; Lycett & Platt, Ltd.

Works canteen, for Brooks & Doxey, Ltd.; W. E. E. Anderson, architect, 12, Imperial Square, Cheltenham.

Mansfield.—Hostel, and canteens at five Domestic Science Centres; W. Thompson, borough surveyor, Town Hall, Mansfield.

Newcastle-on-Tyne.—Decontamination station, Stanmore Road, for the City Council (£3,261); E. Thompson, builder, 12, Grey Street.

Newcastle-under-Lyme.—Day nursery at Cross Heath (£2,325); borough surveyor, Lancaster Buildings, High Street, Newcastle, Staffs.

Northenden.—Premises for Hardy's Crown Brewery Co., Ltd., Hulme; Pye and Bennett, architects, 2, Booth Street, Manchester, 2.

Northumberland.—Canteens at the Duke's School, Alnwick, Choppington Guide Post School and Whitley High School; county architect, County offices, Morpeth.

Northwich.—Fire station scheme; J. Birtwistle, surveyor, Whitehall, Hartford, Northwich, Cheshire.

Oldham.—Nurses' home, Ripponden Road, for Boundary Park General Hospital; G. E. Hardy, borough engineer, municipal offices, 75, Union Street.

Ongar.—Public baths scheme, and provision of British Restaurant, for R.D.C.; surveyor, Council offices, Ongar, Essex.

Poynton.—Fire station at the Crescent; surveyor, Macclesfield R.D.C., Council offices, King Edward Street, Macclesfield.

Rawtenstall.—Offices, Union Works, Cloughfold; W. Holden.

Rotherham.—Canteen, Northfield Road; Pressure Lubricants, Ltd.

Canteen, Steel Street; J. J. Habershon & Sons, Ltd.

Canteens; V. Turner, borough engineer, Town Hall.

Salford.—Extensions; Isaac Bury, Ltd., Adelphi Dye and Finishing Works.

Additions, Duncan Street; F. Hampson, Ltd., Perseverance Glass Works.

Electrical heating at Barr Hill Open-air School, Pendleton; W. A. Walker, borough surveyor, Town Hall, Bexley Square, Salford, 3.

Salisbury (Wilts).—Additional accommodation at Harnwood Hospital (£15,000), for County Council; T. Walker, county architect, County offices, Trowbridge.

Seaton Valley.—British Restaurants at Seghill and High Pit; U.D.C. surveyor.

Shildon (Co. Durham).—A wartime nursery for Durham County Education Committee; F. Willey, 34, Old Elvet, Durham.

Smethwick.—Works canteen; Mansill Booth & Co., Ltd., Cape Stamping Works.

Spondon (Derby).—Adaptation of Chester House as remand home (£900); city engineer, Corporation offices.

Stanley (Co. Durham).—Shelters (£16,074), for U.D.C.; surveyor, Council offices, Coach Road, Outwood, Lofthouse Gate.

Staveley.—Canteens at elementary schools; J. B. McGaw, surveyor, Council offices, Staveley, near Chesterfield.

Stoke-on-Trent.—Shops, Chell Heath estate; city architect.

Sunderland.—Communal feeding centres at South Hylton, Castletown, and Silksworth; C. Emmerson, Rural District Council offices, The Esplanade, Sunderland.

Swinton and Pendlebury.—Conversion of premises, Bolton Road, Clifton, for use as British Restaurant (£1,342); borough engineer, Town Hall, Swinton, Lancs.

Trowbridge.—Erection of building in park adjoining McCall's Mill, for use as British Restaurant; surveyor, Town Hall.

Urmston.—Canteen premises; Ford Motor Co., Ltd., Dagenham.

Wallasey.—Buildings at Seaview Road (£5,254); James Tomkinson.

Warrington.—Day and night nursery, Richmond Avenue; D. Cooper, builder, Clarence Street.

West Hartlepool.—School shelters (£2,520); F. Durkin, borough engineer.

Wigan.—Garage to house police motor vehicles (£1,455); borough engineer, Library Street.